Configuring Traffic Filters and Protocol Prioritization

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Bay Networks *Where Information Flows.*™

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Preface

This guide describes configuring traffic filters to filter and prioritize traffic on a Bay Networks® router.

Before You Begin

Before using this guide, you must complete the following procedures. For a new router:

- Install the router (see the installation guide that came with your router).
- Connect the router to the network and create a pilot configuration file (see *Quick-Starting Routers*, *Configuring BayStack Remote Access*, or *Connecting ASN Routers to a Network)*.

Make sure that you are running the latest version of Bay Networks BayRS™ and Site Manager software. For information about upgrading BayRS and Site Manager, see the upgrading guide for your version of BayRS.

Text Conventions

This guide uses the following text conventions:

bold text	Indicates text that you need to enter and command names and options. Example: Enter **show ip** {**alerts** | **routes**} Example: Use the **dinfo** command.
brackets ([ ])	Indicate optional elements in syntax descriptions. Do not type the brackets when entering the command. Example: If the command syntax is: **show ip interfaces** [**-alerts**], you can enter either: **show ip interfaces** or **show ip interfaces -alerts**.
italic text	Indicates file and directory names, new terms, book titles, and variables in command syntax descriptions. Where a variable is two or more words, the words are connected by an underscore. Example: If the command syntax is: **show at** <*valid_route*> *valid_route* is one variable and you substitute one value for it.
`screen text`	Indicates system output, for example, prompts and system messages. Example: `Set Bay Networks Trap Monitor Filters`
separator (>)	Shows menu paths. Example: Protocols > IP identifies the IP option on the Protocols menu.
vertical line (|)	Separates choices for command keywords and arguments. Enter only one of the choices. Do not type the vertical line when entering the command. Example: If the command syntax is: **show ip** {**alerts** | **routes**}, you enter either: **show ip alerts** or **show ip routes**, but not both.

Acronyms

ANSI	American National Standards Institute
APPN	Advanced Peer-to-Peer Networking
ARP	Address Resolution Protocol
CCITT	International Telegraph and Telephone Consultative Committee (now ITU-T)
CLNP	Connectionless Network Protocol
CSMA/CD	carrier sense multiple access/collision detection
DE	discard eligible
DLC	data link control
DLCI	data link connection identifier
DLCMI	Data Link Control Management Interface
DLSw	data link switching
DSAP	destination service access point
FDDI	Fiber Distributed Data Interface
FTP	File Transfer Protocol
HDLC	high-level data link control
HSSI	high-speed serial interface
ICMP	Internet Control Message Protocol
IP	Internet Protocol
IPX	Internet Packet Exchange
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
ITU-T	International Telecommunications Union–Telecommunications sector (formerly CCITT)
LAN	local area network
LAT	Local Area Transport
LLC	Logical Link Control
LNM	LAN Network Manager

MAC	media access control
MCE1	multichannel E1
MCT1	multichannel T1
MSB	most significant bit
NLPID	network layer protocol ID
OSI	Open Systems Interconnection
OSPF	Open Shortest Path First (protocol)
PPP	Point-to-Point Protocol
PRI	primary rate interface
RIF	routing information field
RII	routing information indicator
RIP	Routing Information Protocol
SAP	service access point
SDLC	Synchronous Data Link Control
SMDS	switched multimegabit data service
SNA	Systems Network Architecture
SNAP	Subnetwork Access Protocol
SNMP	Simple Network Management Protocol
SRB	source routing bridge
SSAP	source service access point
STP	shielded twisted pair
TCP/IP	Transmission Control Protocol/Internet Protocol
Telnet	Telecommunication network
TFTP	Trivial File Transfer Protocol
UDP	User Datagram Protocol
UTP	unshielded twisted pair
VINES	Virtual Network Systems
WAN	wide area network
XNS	Xerox Network System

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Chapter 1
Using Traffic Filters

This chapter describes concepts and terms to help you understand and plan for traffic filter configurations on Bay Networks routers.

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What Are Traffic Filters?

Traffic filters are router files that instruct an interface to selectively handle specified network traffic (packets, frames, or datagrams). You determine which packets receive special handling based on information fields in the packet headers.

Using traffic filters, you can reduce network congestion and control access to network resources by blocking, forwarding, logging, or prioritizing specified traffic on an interface.

Note: Be careful not to confuse traffic filters with other router filters such as *route filters*, which force filtered protocol traffic to take particular routes.

Bay Networks routers support two types of traffic filters:

- *Inbound traffic filters* act on packets that the router is receiving.
- *Outbound traffic filters* act on packets that the router is forwarding.

You can create traffic filters on the following router interfaces:

- Ethernet (10BASE-T and 100BASE-T)
- FDDI
- HSSI
- MCE1
- MCT1
- Synchronous
- Token ring

You can apply multiple traffic filters to a single interface. When more than one filter applies to a packet, the order of filters determines the filtering result.

Inbound Traffic Filters

Inbound traffic filters act on packets arriving at a particular router interface. Most sites use inbound traffic filters primarily for security, to restrict access to nodes in a network.

When you configure inbound traffic filters, you specify a set of conditions that apply to the traffic of a particular bridging or routing protocol. The Configuration Manager supports inbound traffic filters for the following protocols:

- Transparent bridge (four encapsulation methods: Ethernet, 802.2 LLC, 802.2 LLC with SNAP, and Novell Proprietary)
- Native source route bridging (SRB)
- IP
- IPX
- XNS
- OSI
- DECnet Phase IV
- VINES
- DLSw
- LLC2 (APPN and LNM)

Chapter 3 provides protocol-specific information for designing inbound traffic filters. Chapter 6 explains how to use the Configuration Manager to apply inbound traffic filters.

Outbound Traffic Filters

Outbound traffic filters act on packets that the router forwards to a local area network (LAN) or wide area network (WAN) through a particular interface. Most sites use outbound traffic filters to ensure timely delivery of critical data, or to restrict traffic leaving the local network.

Outbound traffic filters are not based on a routing protocol, as are inbound traffic filters. When you configure outbound traffic filters, you specify a set of conditions that apply to the following packet headers:

- Data link control (DLC) header
- IP header

To use outbound traffic filters, you must select Protocol Priority as one of the configured protocols on an interface. Protocol Priority is enabled by default on circuits configured with Frame Relay or PPP. Otherwise, you must enable Protocol Priority the first time you configure outbound traffic filters on an interface.

Chapter 4 provides information for designing outbound traffic filters. Chapter 7 explains how to use the Configuration Manager to enable Protocol Priority and apply outbound traffic filters.

What Is Protocol Prioritization?

Protocol prioritization is an outbound traffic filter mechanism.

With Protocol Priority enabled on an interface, the router sorts traffic into prioritized delivery queues (High, Normal, and Low), called *priority queues*. Priority queues affect the sequence in which data leaves an interface; they do not affect traffic as it arrives at the router. You use outbound traffic filters to specify how traffic is sorted into priority queues. By default, all outbound traffic goes to the Normal queue.

See Chapter 2 to learn more about priority queuing and dequeuing.

Filtering Strategies

This section recommends ways you might use traffic filters in a network. See Appendix B for specific examples.

Direct Traffic

You can create traffic filters that affect a particular protocol's traffic. For example, you can forward all IP traffic to a next-hop address. You can also create traffic filters that affect certain locations on a bridged network. For example, if you want all traffic from a node with a particular source MAC address (perhaps an application server) to take precedence over other traffic, you can use protocol prioritization to assign a high priority to any traffic with that source address.

Drop or Accept Traffic

You can configure a router interface to accept only specified traffic and drop all other packets by configuring inbound traffic filters with specific accept criteria.

Or, to accept most traffic and drop only specified packets, you can configure inbound traffic filters for the traffic you want to drop.

Note: Drop filters are generally more efficient than Accept filters.

For example, to prevent all NetBIOS traffic from entering a particular LAN segment, you can create an inbound traffic filter to drop all packets with a destination or source SAP code of F0.

Prioritize Traffic

You can use protocol prioritization to expedite traffic coming from a particular source or going to a particular destination.

When a router treats all packets equally, there is no way to ensure consistent network services for users who are working with real-time applications. Bulk transfer applications use too much of the available bandwidth and reduce interactive response time. These problems are especially noticeable on low-speed WAN interfaces.

You can also improve application response time and prevent session timeouts by implementing protocol prioritization.

Combine Filters

On most interfaces, you can apply as many as 31 inbound and 31 outbound traffic filters for each protocol. You can configure IP interfaces to support as many as 127 inbound traffic filters.

As you add filters to an interface, the Configuration Manager numbers them chronologically (Filter No. 1, Filter No. 2, Filter No. 3, and so on). The filter rule number determines the filter's *precedence.* Lower numbers have higher precedence; Filter No. 1 has the highest precedence. If a packet matches two filters, the filter with the highest precedence (lowest number) applies.

After you create traffic filters, you can change their precedence by reordering them. See "Changing Filter Precedence" in Chapter 6 (inbound traffic filters) or Chapter 7 (outbound traffic filters).

Build a Firewall

If your filtering strategy involves blocking most or all inbound traffic (a *firewall*) you can create a *Drop-all* filter for each protocol on the interface. That means for each protocol you are filtering, you choose a filter criterion that appears in *every* packet of the protocol (for example, a MAC address).

You can also create exceptions to the Drop-all filter by adding more-specific, higher-precedence filters to allow only specified traffic on an interface. See "Using a Drop-All Filter as a Firewall" in Appendix B for more information about combining filters to accept certain traffic.

Traffic Filter Components

The Configuration Manager creates traffic filters from template files that contain filtering information. Traffic filter templates consist of three components:

- Criteria

  The portion of the incoming packet, frame, or datagram header to be examined

- Ranges

  Numeric values (often addresses) to be compared with the contents of examined packets

- Actions

  What happens to packets that match the criteria and ranges specified in a filter

To create a traffic filter, you apply a filter template to a particular router interface. Table 1-5 (at the end of this chapter) summarizes the inbound and outbound traffic filter criteria and actions supported on specific interfaces.

Criteria

A filter criterion is the portion of a packet, frame, or datagram header to be examined. You can break down any packet into at least three components:

- The DLC (or *data link*) header. Examples of data link header types include:
  - -- Token ring (802.5)
  - -- Ethernet V.2 and IEEE 802.3
  - -- FDDI
  - -- PPP and Bay Networks Standard
  - -- Frame Relay
- The upper-level protocol header. Examples of protocol header types include:
  - -- IP and TCP
  - -- Source route bridging (SRB)
  - -- DLSw
- User data

A traffic filter criterion is defined by a byte length and an offset from common bit patterns (*reference points*) in the data link or protocol header. The criterion includes the *length* of the filtered pattern and an *offset* from the known reference point. The traffic filter uses this information to locate which portion of a packet to examine.

For bridged traffic, predefined criteria are part of the data link header. For routed traffic, a predefined criterion can be part of the data link header or an upper-level protocol header.

Inbound traffic filter criteria use reference points in the upper-level protocol header. You select inbound criteria based on the protocol of the incoming traffic. Outbound traffic filters use reference points in only the IP or DLSw protocol headers. You select outbound criteria based on the WAN protocol configured on the interface (transparent bridge, SRB, PPP, or Frame Relay).

Predefined and User-Defined Criteria

The Configuration Manager provides a selection of default filter criteria (*predefined criteria*) for both inbound and outbound traffic filters. Predefined criteria consist of predefined offsets and lengths from common reference points.

You can also define a criterion based on bit patterns in a packet header that are not supported in predefined criteria (*user-defined criteria*). To apply user-defined criteria, you specify the bit length and offset from a supported reference point. Chapter 3 lists the supported reference points for inbound traffic filters. Chapter 4 lists the reference points for outbound traffic filters.

To fit your site’s traffic patterns, you can use a combination of predefined and user-defined criteria in up to 32 traffic filters on each interface.

Predefined Criteria

Table 1-1 summarizes the predefined inbound traffic filter criteria for supported protocols.

Table 1-1. Predefined Inbound Traffic Filter Criteria

Traffic Type	Predefined Inbound Filter Criteria
Transparent bridge (Four data link encapsulation methods: Ethernet, 802.2 LLC, Novell Proprietary, 802.2 LLC with SNAP)	MAC Address (Source or Destination) Ethernet Type Novell 802.2 LLC Length 802.2 LLC DSAP 802.2 LLC SSAP 802.2 LLC Control 802.2 SNAP Length 802.2 SNAP Protocol ID 802.2 SNAP Ethernet Type
SRB (Native only; IP-encapsulated SRB is not supported)	MAC Address (Source or Destination) DSAP SSAP NetBIOS Name (Source or Destination)
DECnet Phase IV	Area (Source or Destination) Node (Source or Destination)
DLSw	MAC Address (Source or Destination) DSAP SSAP
IP	Type of Service IP Address (Source or Destination) UDP Port (Source and/or Destination) TCP Port (Source and/or Destination) UDP or TCP Source Port UDP or TCP Destination Port Established TCP Protocols Protocol Type
IPX	Network (Source or Destination) Host Address (Source or Destination) Socket (Source or Destination)
OSI	OSI Area (Source or Destination) System ID (Source or Destination)

(continued)

Table 1-1. Predefined Inbound Traffic Filter Criteria *(continued)*

Traffic Type	Predefined Inbound Filter Criteria
LLC2	MAC Address (Source or Destination) DSAP SSAP
VINES	Protocol Type VINES Address (Source or Destination)
XNS	Network (Source or Destination) Address (Source or Destination) Socket (Source or Destination)

Table 1-2 summarizes the predefined outbound traffic filter criteria for data link and IP headers.

Note: See *Configuring DLSw Services* for information about criteria for outbound traffic filters based on the DLSw header.

Table 1-2. Predefined Outbound Traffic Filter Criteria

Header	Traffic Type	Predefined Outbound Filter Criteria
IP header	IP	Type of Service Priority_IP Address (Source and/or Destination) UDP Port (Source and/or Destination) TCP Port (Source and/or Destination) Established TCP Protocol Type
	Native SRB	SSAP Destination Address Source Address
	PPP	Protocol ID
	Frame Relay	2-byte DLCI 3-byte DLCI 4-byte DLCI NLPID

(continued)

Table 1-2. Predefined Outbound Traffic Filter Criteria *(continued)*

Header	Traffic Type	Predefined Outbound Filter Criteria
Data link header	Transparent bridge (Data Link Type)	MAC Address (Source or Destination) Ethernet Type Novell 802.2 Length 802.2 DSAP 802.2 SSAP 802.2 Control 802.2 SNAP Length 802.2 SNAP Protocol ID 802.2 SNAP Ethernet Type
	Native SRB	SSAP DSAP
	PPP	Protocol ID
	Frame Relay	2-byte DLCI 3-byte DLCI 4-byte DLCI NLPID Ethernet Type

User-Defined Criteria

To apply customized criteria that use fields that are not represented in a protocol's predefined criteria, you can create a user-defined criterion. You specify its location in the packet header by specifying the following:

- Reference point

  A known bit position in the packet header

- Offset

  The first position of the filtered bit pattern in relation to the reference point (measured in bits)

- Length

  The total bit length of the filtered pattern

Ranges

For each traffic filter criterion, you also specify the valid *range*, a series of target values that apply to the criterion. For most criteria, you specify an address range. There must be at least one target value for each criterion. The range can be just one value or a set of values.

You enter a minimum and a maximum value to specify the range. For a range of only one value, you enter only the minimum value; the Configuration Manager automatically uses that value for both the minimum and maximum value.

For example, if the filter criteria is MAC Source Address, you must specify *which* addresses you want the filter to examine. If you specify 0x0000A2000001 as the minimum range value and 0x0000A2000003 as the maximum range value, the router checks for packets with a MAC source address between 0x0000A2000001 and 0x0000A2000003, inclusive.

Note: Chapter 5 lists valid ranges for common traffic filter criteria and explains how to specify some common address ranges.

Actions

The filter *action* determines what happens to packets that match a filter criterion's ranges. You can apply the following actions to any traffic filter:

- Accept

  The router processes any packet that matches the filter criteria and ranges.

- Drop

  The router does not route any packet that matches the filter criteria and ranges.

- Log

  For every packet that matches the filter criteria and ranges, the router sends an entry to the system Events log. You can specify the Log action in combination with other actions.

Note: Specify the Log action only to record abnormal events; otherwise, the Events log will fill up with filtering messages, leaving no room for critical log messages.

Table 1-3 lists additional protocol-specific actions for inbound traffic filters. See Chapter 3 for more information.

Table 1-3. Inbound Traffic Filter Actions

Protocol	Inbound Traffic Filters
All protocols	Drop Accept Log
Transparent bridge	Flood Forward to Circuit List
Native SRB	Direct IP Explorers Forward to Circuits
DLSw	Forward to Peer
IP	Forward to Next Hop Drop If Next Hop Is Unreachable Forward to IP Address Forward to Next Hop Interface Forward to First Up Next Hop Interface Detailed Logging

Table 1-4 lists the actions for outbound traffic filters. See Chapter 4 for more information.

Table 1-4. Outbound Traffic Filter Actions

Filtering Actions	Prioritizing Actions*	Dial Service Actions
Drop	High Queue	No Call
Accept	Low Queue	No Reset
Log	Length	
Detailed Log		

* Outbound traffic filters with a prioritizing action are sometimes called *priority filters.*

Except for the log actions, inbound and outbound traffic filter actions are mutually exclusive; you can only apply one action to each filter.

Using Filter Templates

When you create traffic filters, it is important to understand the difference between a traffic filter template and an actual traffic filter.

A traffic filter *template* is a reusable, predefined specification for a traffic filter. Each template contains a complete filter specification (criterion, range, and action) for one protocol, but is not associated with a specific interface or circuit.

You create an actual traffic filter when you use the Configuration Manager to apply (save) a traffic filter template to a configured router interface. You can apply a single template to as many interfaces as you want, thus creating multiple filters for that protocol.

When you want to add a filter to an interface, you have several options:

- If there is a template that contains the exact filtering instructions you want for this interface, apply that template to the interface.
- If there is a template that contains filtering instructions similar to what you want, copy, rename, and edit the template. Then, apply the new template to the appropriate interface.
- If there is no template containing filtering instructions similar to what you want for this interface, you must create a template from scratch. Then, apply the new template to the appropriate interface.
- If there is an existing filter on the interface that contains instructions similar to what you want, edit the existing filter and save it.

Summary of Traffic Filter Support

Table 1-5 summarizes the inbound and outbound traffic filter criteria and actions supported on specific interfaces.

Table 1-5. Summary of Traffic Filter Support

Network Interface	Protocol Criteria Supported		Filter Actions Supported	
	Inbound	**Outbound**	**Inbound**	**Outbound**
Ethernet (10BASE-T or 100BASE-T)	Transparent bridge*, DECnet IV, DLSw, IP, IPX, LLC2, OSI, SRB, XNS, VINES	Transparent bridge, IP, SRB	Accept, Drop, Log †	Accept, Drop, Log
FDDI	Transparent bridge‡, DECnet IV, DLSw, IP, IPX, LLC2, OSI, SRB, XNS, VINES	Transparent bridge, IP, SRB	Accept, Drop, Log †	Accept, Drop, Log
Token ring	Transparent bridge‡, DECnet IV, DLSw, IP, IPX, LLC2, OSI, SRB, XNS, VINES	Transparent bridge, IP, SRB	Accept, Drop, Log †	Accept, Drop, Log
HSSI	Transparent bridge*, DECnet IV, DLSw, IP, IPX, LLC2, OSI, SRB, XNS, VINES	Transparent bridge, Frame Relay, IP, PPP, SRB	Accept, Drop, Log †	Accept, Drop, Log
MCE1	Transparent bridge, DECnet IV, DLSw, IP, IPX, LLC2, OSI, SRB, XNS, VINES	Transparent bridge, Frame Relay, IP, PPP, SRB	None	Accept, Drop, Log, High Queue, Low Queue, Length, No Call, No Reset
MCT1	Transparent bridge, DECnet IV, DLSw, IP, IPX, LLC2, OSI, SRB, XNS, VINES	Transparent bridge, Frame Relay, IP, PPP, SRB	None	Accept, Drop, Log, High Queue, Low Queue, Length, No Call, No Reset
Synchronous	Transparent bridge*, DECnet IV, DLSw, IP, IPX, LLC2, OSI, SRB, XNS, VINES	Transparent bridge, Frame Relay, IP, PPP, SRB	Accept, Drop, Log †	Accept, Drop, Log, High Queue, Low Queue, Length, No Call, No Reset

* Ethernet, 802.2 LLC, LLC with SNAP, and Novell encapsulations

† Plus additional actions for transparent bridge, SRB, and IP filters (see Chapter 3).

‡ 802.2 LLC and LLC with SNAP encapsulations

Chapter 2
Using Protocol Prioritization Queues

This chapter describes the priority queues that you can implement using outbound traffic filters (*protocol prioritization*).

Topic	Page
About Protocol Prioritization	2-1
Enabling Protocol Prioritization	2-9
Tuning Protocol Prioritization	2-10

For instructions on using the Configuration Manager to create outbound traffic filters, see Chapter 7.

About Protocol Prioritization

Site Manager supports protocol prioritization on synchronous (serial), HSSI, MCE1, and MCT1 interfaces for the following WAN protocols:

- PPP
- Bay Networks Standard PPP
- Frame Relay

Note: The DLSw software also allows you to prioritize traffic *within* DLSw, based on predefined or user-defined fields at the TCP level. For information about these DLSw prioritization filters, see *Configuring DLSw Services*.

While the router is operating, network traffic from various sources converges at each WAN interface. Without protocol prioritization, the router transmits packets in a first in, first out (FIFO) order.

With Protocol Priority enabled on an interface, the router sorts traffic into prioritized delivery queues (High, Normal, and Low), called *priority queues*. The router uses a dequeuing algorithm to empty the priority queues to transmit traffic.

Generally, the router transmits higher-priority traffic first. Other configurable values in the protocol prioritization scheme also affect the transmission of traffic. Two of these values are the maximum size of the queue (*queue depth*) and the line delay (*latency*), described in "Tuning Protocol Prioritization" later in this chapter.

Protocol prioritization is considered an outbound filter mechanism for these reasons:

- You use outbound traffic filters to specify how traffic is prioritized.
- Priority queues affect the sequence in which data leaves an interface; they do not affect traffic as it arrives at the router.

Outbound traffic filters include prioritizing actions for specifying priority queues. See "Prioritizing Actions" in Chapter 4.

The following sections describe how the router prioritizes traffic into queues, and the options for dequeuing:

- Priority Queuing
- The Dequeuing Process

Priority Queuing

With protocol prioritization enabled on an interface, the router sends each packet leaving an interface to one of three priority queues:

- High queue
- Normal queue
- Low queue

The router automatically queues packets that do not match a priority filter to the Normal queue. To send traffic to the other queues, you create outbound traffic filters that include a prioritizing action. These are called *priority filters.*

The Dequeuing Process

After queuing packets, the router empties the priority queues by sending the traffic to the transmit queue using one of two dequeuing algorithms:

- Bandwidth Allocation Algorithm
- Strict Dequeuing Algorithm

By default, protocol prioritization uses the bandwidth allocation algorithm to send traffic from the three priority queues to the transmit queue. You specify the active dequeuing algorithm by setting the Prioritization Algorithm Type parameter, as described in “Editing Protocol Prioritization Parameters” later in this chapter.

Figure 2-1 illustrates the dequeuing process, with default configuration values.

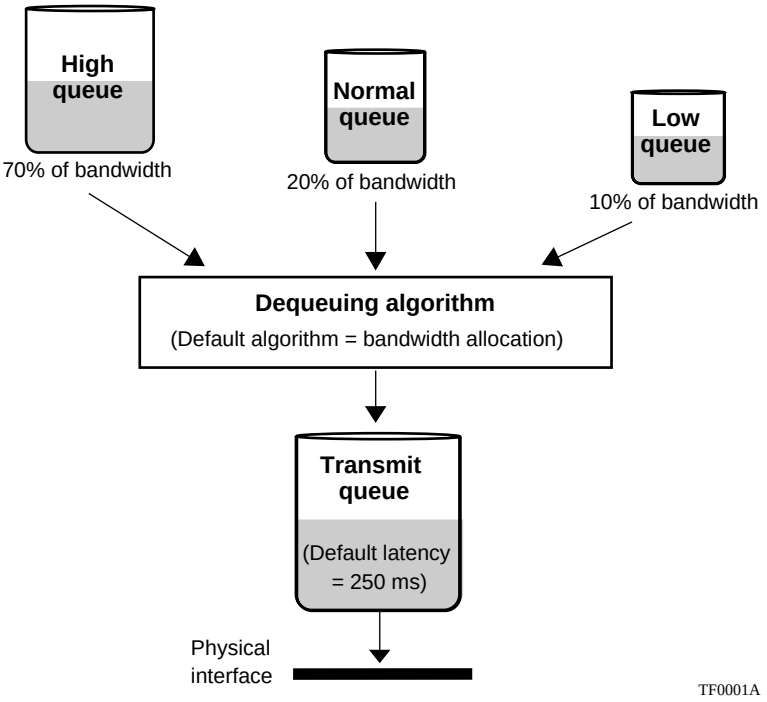

Figure 2-1. Protocol Prioritization Dequeuing

Bandwidth Allocation Algorithm

The bandwidth allocation algorithm uses a configurable percentage of bandwidth for each of the three priority queues to determine how to transmit queued traffic. The default configuration is as follows:

- High queue -- 70% of bandwidth
- Normal queue -- 20% of bandwidth
- Low queue -- 10% of bandwidth

When the amount of traffic transmitted from a particular queue reaches the configured percentage, the next-higher-priority queue begins to transmit traffic.

The amount of actual data transmitted depends on the clock speed of the circuit. You can configure the clock speed on a synchronous interface by setting the External Clock Speed parameter in the Configuration Manager Edit Sync Parameters window. (See *Configuring WAN Line Services*.)

The bandwidth allocation algorithm works as follows:

1. The transmit queue scans the High queue.

   If there is no traffic in the High queue, the algorithm proceeds to step 3.

2. The router empties all packets from the High queue, up to the configured bandwidth percentage, into the transmit queue and then transmits the packets.

   The default bandwidth percentage for the High queue is 70 percent. If the actual bandwidth use is less than the limit, the router empties the High queue and proceeds to the Normal queue.

3. The transmit queue scans the Normal queue.

   If there is no traffic in the Normal queue, the algorithm proceeds to step 5.

4. The router empties all packets from the Normal queue, up to the configured bandwidth percentage, into the transmit queue and then transmits the packets.

   The default bandwidth percentage for the Normal queue is 20 percent. If the actual bandwidth use is less than the limit, the router empties the Normal queue and proceeds to the Low queue.

5. The transmit queue scans the Low queue.

   If there is no traffic in the Low queue, the algorithm returns to step 1.

6. The router empties all packets from the Low queue, up to the configured bandwidth percentage, into the transmit queue and then transmits the packets.

   The default bandwidth percentage for the Low queue is 10 percent. If the actual bandwidth use is less than the limit, the router empties the Low queue.

7. The algorithm returns to step 1.

Figure 2-2 illustrates the bandwidth allocation algorithm.

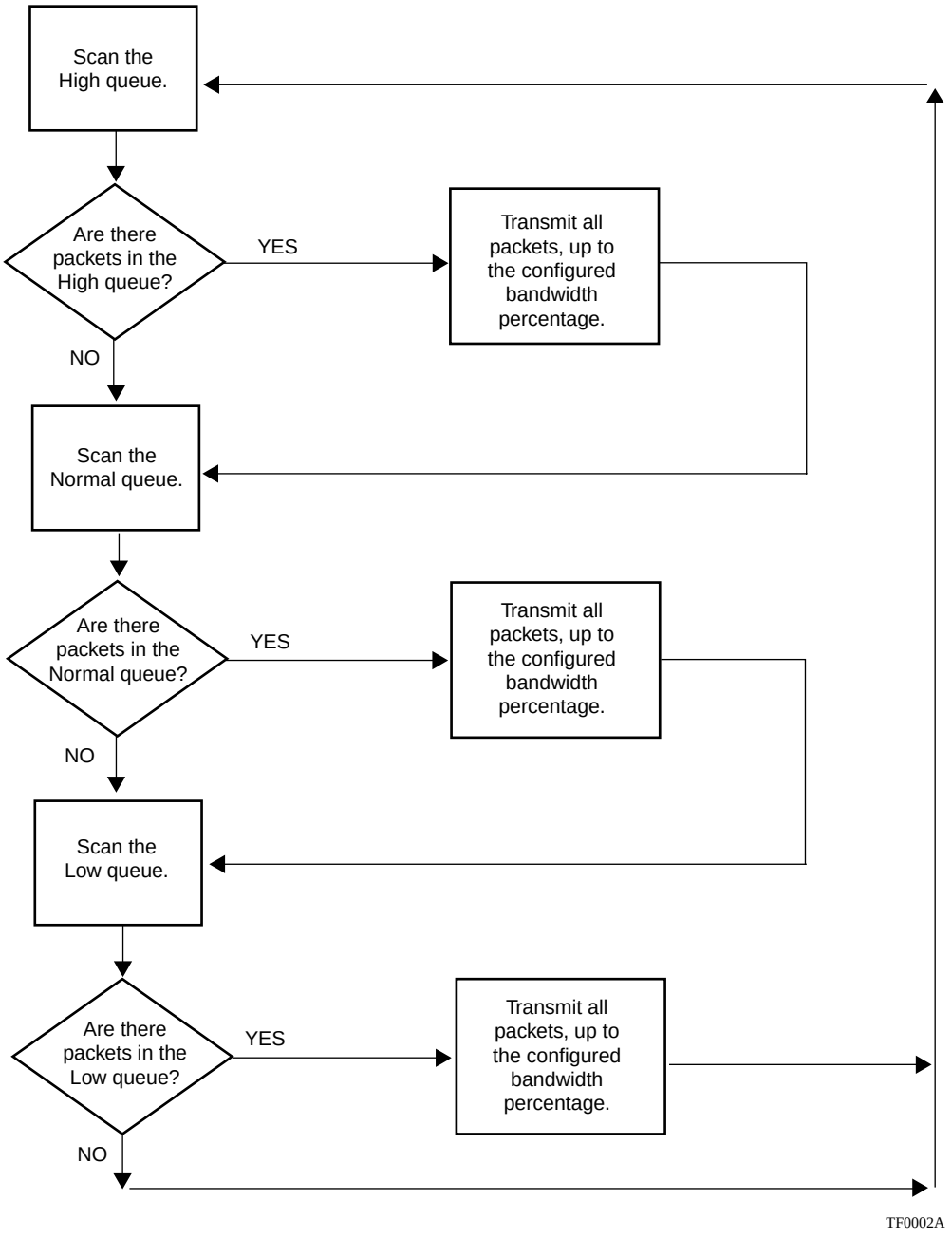
Scan the High queue.
Are there packets in the High queue?
YES
Transmit all packets, up to the configured bandwidth percentage.
NO
Scan the Normal queue.
Are there packets in the Normal queue?
YES
Transmit all packets, up to the configured bandwidth percentage.
NO
Scan the Low queue.
Are there packets in the Low queue?
YES
Transmit all packets, up to the configured bandwidth percentage.
NO
TF0002A

Figure 2-2. Bandwidth Allocation Algorithm

Strict Dequeuing Algorithm

Instead of the bandwidth allocation algorithm, you can configure the router to use the strict dequeuing algorithm to send traffic to the transmit queue.

Caution: If the router uses the strict dequeuing algorithm and there is a great deal of High queue traffic on the network, Normal and Low queue traffic may never be transmitted.

The strict dequeuing algorithm works as follows:

1. The transmit queue scans the High queue.

   If there is no traffic in the High queue, the algorithm proceeds to step 4.

2. The router empties all packets from the High queue into the transmit queue, up to the latency value or the maximum transmit queue size, and then transmits the packets.

   The transmit queue size is the maximum number of packets in the transmit queue at one time. You cannot configure this number using Site Manager.

3. If the latency value is reached, the transmit queue returns to step 1, scanning and emptying traffic from the High queue.

   If neither the latency value nor the maximum transmit queue size is reached, the algorithm proceeds to step 4.

4. The transmit queue scans the Normal queue.

   If there is no traffic in the Normal queue, the algorithm proceeds to step 7.

5. The router empties all packets from the Normal queue, up to the latency value, into the transmit queue and then transmits the packets.

6. If the latency value is reached, the transmit queue returns to step 1, scanning and emptying traffic from the High queue.

   If the latency value is not reached, the algorithm proceeds to step 7.

7. The transmit queue scans the Low queue.

   If there is no traffic in the Low queue, the algorithm returns to step 1.

8. The router empties all packets from the Low queue, up to the latency value, into the transmit queue and then transmits the packets.

9. The algorithm returns to step 1, whether or not the latency value is reached.

Figure 2-3 illustrates the strict dequeuing algorithm.

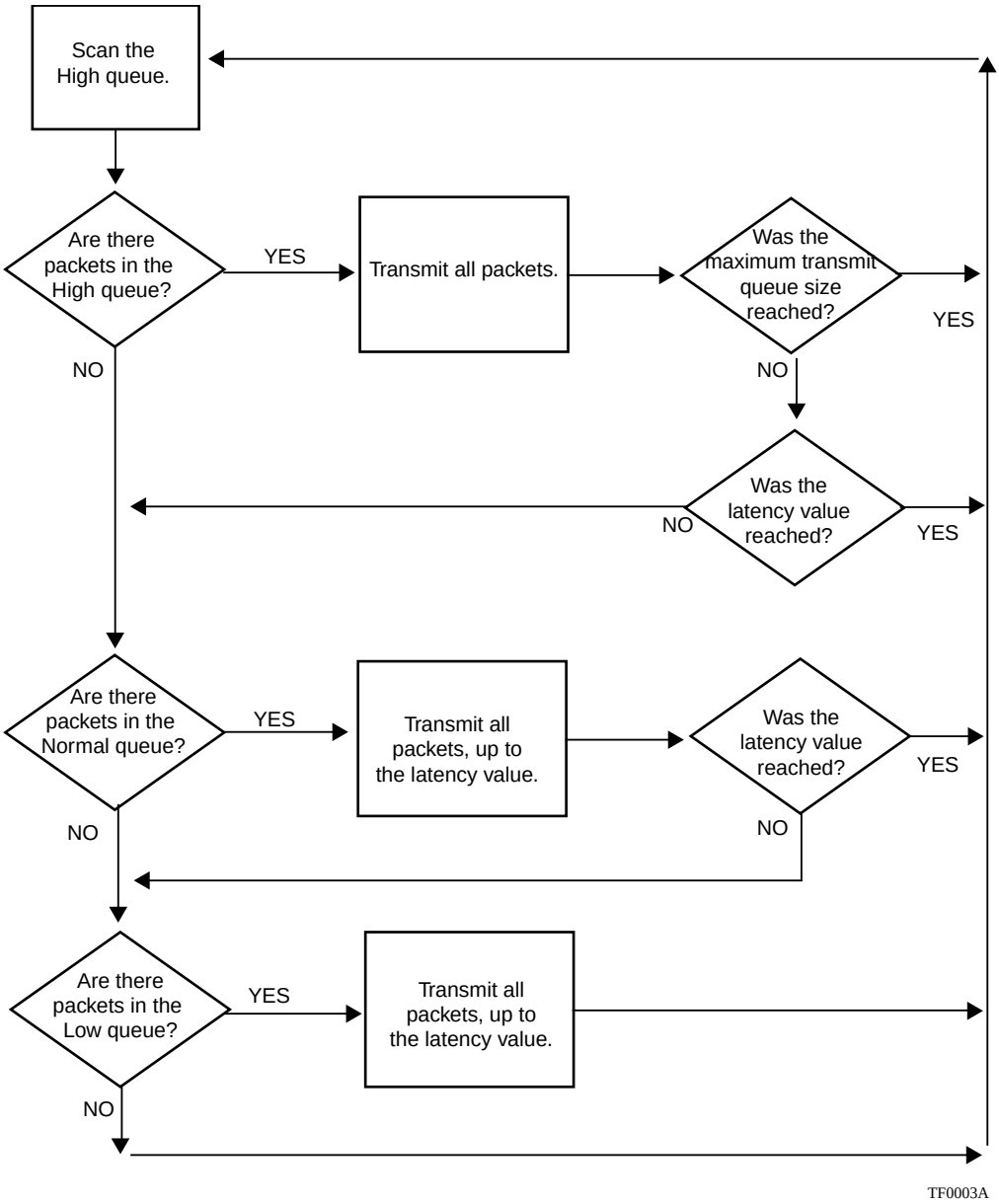

Figure 2-3. Strict Dequeuing Algorithm

Enabling Protocol Prioritization

You use the Configuration Manager to configure protocol prioritization. To configure priority queues with default values, do the following:

1. Enable Protocol Priority on the circuit, as described in this section.
2. Apply outbound traffic filters with prioritizing actions to the circuit, as described in Chapter 7.

See the next section,"Tuning Protocol Prioritization," to learn how to customize the way protocol prioritization works on a circuit.

To enable protocol prioritization:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, click on the circuit interface connector on which you want to configure protocol prioritization.	The Edit Connector window opens.
2. Click on **Edit Circuit**.	The Circuit Definition window opens; the circuit you selected is highlighted.
3. Look for Protocol Priority in the Protocols scroll box. Site Manager automatically enables protocol prioritization for certain WAN protocols.	If Protocol Priority appears in the Protocols scroll box, protocol prioritization is already enabled for this interface.
4. If Protocol Priority does not appear in the Protocols scroll box, choose Protocols > Add/Delete.	The Select Protocols window opens.
5. Scroll down the list of protocols and select Protocol Priority.	
6. Click on **OK**.	The Circuit Definition window opens.

From the Circuit Definition window, you can do the following:

- Edit configuration parameters, as described in "Editing Protocol Prioritization Parameters" later in this chapter.
- Configure an outbound traffic filter with a priority queue action, as described in Chapter 7.

Tuning Protocol Prioritization

When you enable Protocol Priority on a circuit, the router uses default values that help determine how priority filters work. These defaults are designed to work well for most configurations. However, you can customize (or *tune*) protocol prioritization to maximize its impact on your network.

This section covers the following topics:

- Tuning Concepts
- Editing Protocol Prioritization Parameters
- Monitoring Protocol Prioritization Statistics

Tuning Concepts

How you tune protocol prioritization depends on whether you are using the bandwidth allocation algorithm or strict dequeuing algorithm. (See "The Dequeuing Process" earlier in this chapter.)

To tune priority queuing with the bandwidth allocation algorithm, consider adjusting the following configuration defaults:

- Percent of Bandwidth
- Queue Size

To tune priority queuing with the strict dequeuing algorithm, consider adjusting the following configuration defaults:

- Queue Size
- Latency

Percent of Bandwidth

When using the bandwidth allocation algorithm, you can change the default allocation of bandwidth for each of the three priority queues.

Queued traffic with large packets often require more than the default bandwidth allocation. For example, if statistics indicate that one interface requires more than 70 percent of bandwidth to properly transmit high-priority traffic, you can increase the High Queue Size parameter and decrease the Normal or Low Queue Size parameter.

Note: If statistics indicate that the High queue does not have enough buffers, consider reducing the amount of high-priority traffic. You should be selective in assigning high-priority status. Too many traffic types with high-priority status can defeat the purpose of protocol prioritization. With the strict dequeuing algorithm, too much high-priority traffic can result in discarding (or *clipping*) normal- and low-priority traffic.

To configure the percent of bandwidth for the priority queues, you edit these Configuration Manager parameters:

- High Queue Percent Bandwidth
- Normal Queue Percent Bandwidth
- Low Queue Percent Bandwidth

When changing bandwidth allocation, remember that the percent of bandwidth for the High queue, Normal queue, and Low queue must total 100 percent.

Queue Size

Queue size (or *queue depth*) is the configurable number of packets that each priority queue can hold. The default value for bandwidth allocation is 20 packets, regardless of packet size.

Note: The buffer size for priority queues is not configurable when using the strict dequeuing algorithm.

When you set the queue size, you assign buffers (which hold the packets) to each queue. A queue is full when it exceeds the buffer size. The router discards (clips) traffic sent to a full queue.

To configure queue size, you edit these Configuration Manager parameters:

- High Queue Size
- Normal Queue Size
- Low Queue Size
- High Water Packets Clear

Queue Size Example

Suppose that you use the default queue size (20 packets) for all three priority queues. The statistics indicate that the High queue's Clipped Packets Count is 226, and its High-Water Packets Mark is 20. This indicates that the High queue has been full at least once and that the router has discarded 226 packets.

From this information, you can conclude that you have not assigned enough buffers to the High queue for the amount of high-priority traffic on this interface.

To prevent additional high-priority traffic from being discarded, you can reconfigure the size of the queues or reevaluate the amount of traffic assigned to the High queue.

Reconfiguring Queue Size

Suppose that you now look at the statistics of the Normal and Low queues and find that the Low queue has a Clipped Packets Count of zero and a High-Water Packets Mark of 06 (Figure 2-4). Therefore, you can conclude that there have never been more than six packets in the Low queue, and the router has not discarded any low-priority packets.

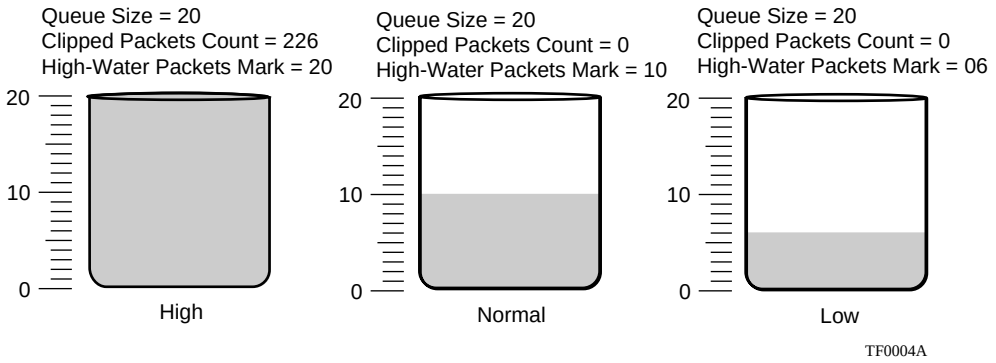

Figure 2-4. Priority Queue Statistics for the Queue Size Example

In this case, you may choose to decrease the Low queue size to 10, and increase the High queue size to 30 (Figure 2-5).

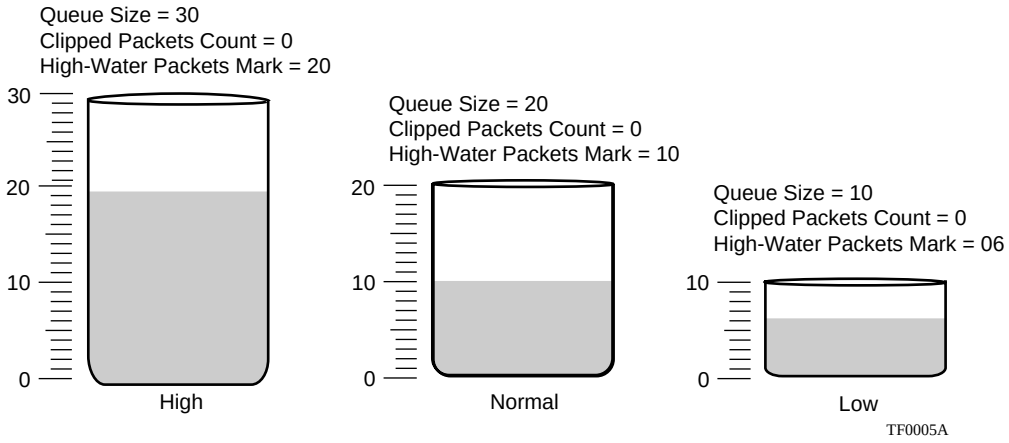

Figure 2-5. Reconfigured Priority Queue Statistics for the Queue Size Examples

To see whether this reallocation solves the problem, reset the Clipped Packets Count and High-Water Packets Mark counters using the Statistics Manager and check them again later.

Latency

Line delay, or *latency*, indicates how many bits of normal- or low-priority traffic the router can allocate to the transmit queue at any one time. The latency value is the greatest time delay that a high-priority packet can experience.

Latency is based on the line speed of the attached media. The following formula illustrates how the line speed, bits queued, and latency value are related:

Latency = Bits Queued / Line Speed (b/s)

The default value for latency is 250 milliseconds (ms). This value generally ensures good throughput and maintains rapid terminal response (rapid echoing of keystrokes and timely response to commands) over most media.

You can change the default latency value by setting the Max High Queue Latency parameter. Keep in mind, however, that if you specify a higher latency value (thus allowing more room on the transmit queue), throughput increases, but terminal response time decreases. Bay Networks recommends using the default value of 250 ms.

Editing Protocol Prioritization Parameters

To edit protocol prioritization parameters:

Site Manager Procedure	
You do this	**System responds**
1. In the Circuit Definition window, choose Protocols > Edit Protocol Priority > Interface.	The Edit Protocol Priority Interface window opens.
2. Select the parameter you want to change. To see additional parameters, use the scroll bar on the right side of the window.	
3. For a description of the parameter, click on **Help** in the Site Manager window, or refer to the appropriate parameter description in Appendix A: • Enable • High Queue Size • Normal Queue Size • Low Queue Size • Max High Queue Latency • High Water Packets Clear • Prioritization Algorithm Type • High Queue Percent Bandwidth • Normal Queue Percent Bandwidth • Low Queue Percent Bandwidth • Discard Eligible Bit Low • Discard Eligible Bit Normal	
4. Click on **Values**.	The Values Selection window opens, listing valid values for the parameter.
5. Select the value you want, then click on **OK**.	The Values Selection window closes. The Edit Protocol Priority Interface window now displays the new value.
6. Click on **OK** when you are done setting protocol prioritization parameters.	You return to the Circuit Definition window.

Monitoring Protocol Prioritization Statistics

To monitor and manage protocol prioritization, you use the Statistics Manager to view statistics in the MIB object group *wfApplication.wfDatalink.wfProtocolPriorityGroup*. For information about using the Statistics Manager to view MIB objects and create custom screen reports, see *Configuring and Managing Routers with Site Manager*.

To determine whether there are enough buffers in each priority queue for the traffic flow on your network, use the Statistics Manager to examine the following protocol prioritization statistics:

- High-Water Packets Mark

  The greatest number of packets that have been in each queue.

- Clipped Packets Count

  The number of packets that have been discarded from each queue. (The router discards packets from priority queues that become full.)

Note: To determine whether statistics reflect a transient event, you may want to reset the statistics and check again later before changing the priority queuing configuration. You can reset the High-Water Packets Mark using the Configuration Manager Edit Protocol Priority Interface window. You can reset both the Clipped Packets Count and High-Water Packets Mark using the Statistics Manager.

Generally, if a queue's Clipped Packets Count is high and the High-Water Packets Mark is close to its queue size, that queue does not have enough buffers.

Chapter 3
Inbound Traffic Filter Criteria and Actions

You create inbound traffic filters using templates that consist of protocol-specific filter criteria, ranges, and actions. To define an inbound traffic filter template, you need to know the specific criteria and actions that Site Manager supports for the applicable protocol.

This chapter lists the following for supported bridging and routing protocols:

- Predefined inbound traffic filter criteria and actions
- Reference points for specifying user-defined criteria

Topic	Page
Transparent Bridge Criteria and Actions	3-2
Source Route Bridging Criteria and Actions	3-5
DECnet Phase IV Criteria and Actions	3-7
DLSw Criteria and Actions	3-8
IP Criteria and Actions	3-9
IPX Criteria and Actions	3-11
LLC2 Criteria and Actions	3-12
OSI Criteria and Actions	3-13
VINES Criteria and Actions	3-14
XNS Criteria and Actions	3-15

For an overview of traffic filters, templates, and their criteria, ranges, and actions, see Chapter 1. For instructions on using Site Manager to create inbound traffic filters, see Chapter 6.

Transparent Bridge Criteria and Actions

Transparent bridge traffic filters support several encapsulation methods and media types. You filter inbound transparent bridge frames based on the contents of the header fields for one of the four supported encapsulation methods:

- Ethernet
- IEEE 802.2 LLC
- IEEE 802.2 LLC with SNAP
- Novell Proprietary

Figure 3-1 illustrates the header reference fields for each encapsulation method.

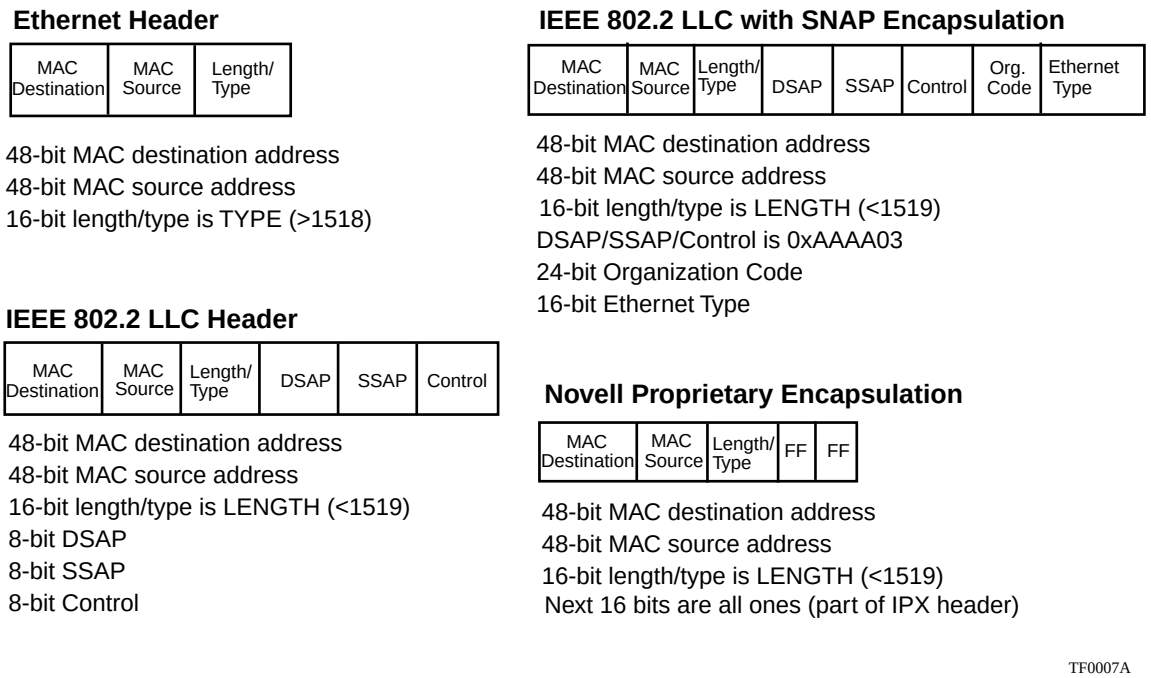

Figure 3-1. Header Reference Fields for Transparent Bridge Encapsulation Methods

Table 3-1 indicates which encapsulation methods are supported for specific router interfaces.

Table 3-1. Transparent Bridge Encapsulation Support

Router Interface	Encapsulation Method			
	Ethernet	802.2 LLC	LLC with SNAP	Novell
Ethernet/802.3 (XCVR)	Yes	Yes	Yes	Yes
FDDI (FDDI)	No	Yes	Yes	No
Token ring (TOKEN)	No	Yes	Yes	No
Synchronous (COM)	Yes	Yes	Yes	Yes

Predefined Transparent Bridge Criteria

Each transparent bridge encapsulation method has specific, predefined criteria for filtering frames. These predefined criteria are based on an offset to a header reference field (Figure 3-1) and are a specified length. Table 3-2 lists the predefined criteria for each encapsulation method, and the reference field, offset, and length for each criterion.

Table 3-2. Predefined Criteria for Transparent Bridge Inbound Traffic Filters

Encapsulation Method	Criterion Name	Reference Field	Offset (bits)	Length (bits)
All	MAC Source Address	MAC	0	48
	MAC Destination Address	MAC	48	48
Ethernet	Ethernet Type	MAC	96	16
802.2 LLC	Length (Ethernet/802.3 and PPP only)	MAC	96	16
	SSAP	DATA_LINK	0	8
	DSAP	DATA_LINK	8	8
	Control	DATA_LINK	16	8
802.2 LLC with SNAP	Length	MAC	96	16
	Organization Code (Protocol ID)	DATA_LINK	24	24
	Ethernet Type	DATA_LINK	48	16
Novell	Novell	MAC	112	16

User-Defined Transparent Bridge Criteria

You can create bridge traffic filters with user-defined criteria by specifying an offset and length to these supported reference fields:

Reference Field	Description
MAC	Points to the first byte of the MAC Destination Address
DATA_LINK	Points to the first byte of the DATA_LINK reference field

Transparent Bridge Actions

In addition to the Accept, Drop, and Log actions that are common to all inbound traffic filters, there are two transparent bridge actions:

- Flood

  Specifies that any frame that matches the filter will be forwarded to all transparent bridge circuits, except for the circuit from which it was received

- Forward to Circuit List

  Specifies that any frame that matches the filter will be forwarded to the specified circuits

Note: The circuit names that you specify for the Forward to Circuits action are case-sensitive. For example, if the circuit name is E21, but you type **e21**, the filter will not be saved.

You can specify the Log action with any of the other actions. However, you should specify the Log action only to record abnormal events; otherwise, the Events log will fill up with filtering messages, leaving no room for critical log messages.

Source Route Bridging Criteria and Actions

You filter inbound source route bridging (SRB) traffic based on specified bit patterns in the native SRB frame header. IP-encapsulated SRB traffic filters are not supported.

SRB filters affect both explorer and routed frames. However, filters that include Next Ring as a criterion affect only routed frames because the Next Ring reference field does not appear in explorer frames. See *Configuring Bridging Services* for information about explorer and routed frames.

Note: The router applies SRB filters *after* it processes a packet. The router receives the packet on the incoming interface and updates the routing information field (RIF). The filters that you configure then act on the updated RIF.

Predefined SRB Criteria

Table 3-3 lists the predefined criteria for SRB inbound traffic filters, and the reference field, offset, and length for each SRB criterion.

Table 3-3. Predefined Criteria for SRB Inbound Traffic Filters

Criterion Name	Reference Field	Offset (bits)	Length (bits)
Next Ring	NEXT_RING	0	12
Destination MAC Address	HEADER_START	0	48
Source MAC Address	HEADER_START	48	48
DSAP	DATA_LINK	0	8
SSAP	DATA_LINK	8	8
Destination NetBIOS Name	DATA_LINK	120	120
Source NetBIOS Name	DATA_LINK	248	120

Specifying an SRB Criterion Range

If you create an SRB filter that includes a Source or Destination NetBIOS Name criterion, you type the NetBIOS name as the ASCII equivalent of the first 15 characters of the name. If the name has fewer than 15 characters, use ASCII spaces (0x20) to ensure that the name has exactly 15 characters.

See Chapter 5 for information about specifying SAP and MAC address criteria.

User-Defined SRB Criteria

In addition to the predefined filter criteria, you can create SRB inbound traffic filters with user-defined criteria by specifying an offset and length to these reference fields in the SRB header:

Reference Field	Description
NEXT_RING	Points to the first byte of the NEXT_RING reference field
HEADER_START	Points to the first byte of the Destination MAC Address
DATA_LINK	Points to the first byte of the DATA_LINK reference field

SRB Actions

In addition to the Accept, Drop, and Log actions common to all inbound traffic filters, there are two SRB actions:

- Direct IP Explorers

  Specifies that any explorer frame that matches the filter will be sent to some number of IP addresses. You must specify these IP addresses.

  For this action to work, IP encapsulation must be configured on the filter's interface. If IP encapsulation is not configured and a frame matches the filter, the frame will be flooded as if no filter exists.

- Forward to Circuits

  Specifies that any frame that matches the filter will be forwarded to some number of circuits on the same router. You must specify these circuits.

Note: The circuit names that you specify for the Forward to Circuits action are case-sensitive. For example, if the circuit name is E21, but you type **e21**, the filter will not be saved.

You can specify the Log action with any of the other actions. However, you should specify the Log action only to record abnormal events; otherwise, the Events log will fill up with filtering messages, leaving no room for critical log messages.

DECnet Phase IV Criteria and Actions

You can filter inbound DECnet Phase IV traffic based on specified bit patterns in the DECnet header.

Predefined DECnet Criteria

Table 3-4 lists the predefined criteria for DECnet Phase IV inbound traffic filters, and the reference field, offset, and length for each criterion.

Table 3-4. Predefined Criteria for DECnet Phase IV Inbound Traffic Filters

Criterion Name	Reference Field	Offset	Length
Destination Area	DEC4_BASE	0	6
Destination Node	DEC4_BASE	6	10
Source Area	DEC4_BASE	16	6
Source Node	DEC4_BASE	22	10

User-Defined DECnet Criteria

In addition to the predefined DECnet Phase IV filter criteria, you can create traffic filters with user-defined criteria by specifying an offset and length to this reference field in the DECnet header:

Reference Field	Description
DEC4_BASE	Points to the first byte in the header

DECnet Actions

The DECnet Phase IV filtering actions are Accept, Drop, and Log.

DLSw Criteria and Actions

You can filter inbound DLSw traffic based on specified bit patterns in the DLSw header, as defined in RFC 1434.

Predefined DLSw Criteria

Table 3-5 lists the predefined criteria for DLSw inbound traffic filters, and the reference field, offset, and length for each criterion.

Table 3-5. Predefined Criteria for DLSw Inbound Traffic Filters

Criterion Name	Reference Field	Offset	Length
Destination MAC Address	DLS_BASE	192	48
Source MAC Address	DLS_BASE	240	48
DSAP	DLS_BASE	296	8
SSAP	DLS_BASE	288	8

User-Defined DLSw Criteria

In addition to the predefined DLSw filter criteria, you can create inbound traffic filters with user-defined criteria by specifying an offset and length to these reference fields in the DLSw header:

Reference Field	Description
DLS_CTRL_START	Points to the start of the DLSw header
DLS_DATA_START	Points to the start of the DLSw data

DLSw Actions

The DLSw filtering actions are as follows:

- Drop, Log -- Common to all inbound traffic filters
- Forward to Peer -- Any frame that matches the filter will be sent to the specified DLSw circuits

IP Criteria and Actions

You can filter IP inbound traffic based on specified bit patterns in one of the following headers in an IP datagram:

- The IP header
- The header of the upper-level protocol (TCP or UDP, for example)

Predefined IP Criteria

Table 3-6 lists the predefined criteria for IP inbound traffic filters, and the reference field, offset, and length for each criterion.

Table 3-6. Predefined Criteria for IP Inbound Traffic Filters

Criterion Name	Reference Field	Offset	Length
Type of Service	HEADER_START	8	8
Protocol ID	HEADER_START	72	8
IP Source Address	HEADER_START	96	32
IP Destination Address	HEADER_START	128	32
UDP or TCP Source Port	HEADER_END	0	16
UDP or TCP Destination Port	HEADER_END	16	16
Established TCP*	HEADER_END	107	3

* Allows filtering on the ACK and RESET bits in the TCP header. You do not specify a range for this criterion.

User-Defined IP Criteria

In addition to the predefined filter criteria, you can create IP inbound traffic filters with user-defined criteria by specifying an offset and length to these reference fields in the IP header:

Reference Field	Description
HEADER_START	Points to the first byte of the Type of Service
HEADER_END	Points to the last byte of the IP Destination Address

When specifying the user-defined criterion length, use 8 bits whenever possible. IP inbound traffic filters with a length of 1 bit work only when aligned on a byte (word) boundary. Lengths from 2 to 7 bits do not work.

IP Actions

In addition to the Accept, Drop, and Log actions common to all inbound traffic filters, there are the following IP actions:

- Forward to Next Hop

  Specifies that any frame that matches the filter will be forwarded to the next-hop router. You must specify the IP address of the next-hop router. If the next-hop router is not reachable, any packets matching the filter will be forwarded normally unless you also specify Drop If Next Hop Is Unreachable.

  If you specify 255.255.255.255 as the next hop, any frame that matches this filter will be forwarded normally.

- Drop If Next Hop Is Unreachable

  This action is valid only when Forward to Next Hop is in use. It specifies that if the next-hop address specified is unreachable, the frame is dropped.

- Forward to IP Address

  Specifies that any frame that matches the filter will be forwarded to a single address in a list of specified IP addresses. The destination address of the original packet changes to the specified IP address.

- Forward to Next Hop Interfaces

  Specifies that any frame that matches the filter will be duplicated and forwarded to a group of next-hop IP addresses that you specify. If none of the next-hop interfaces is active, the router forwards packets that match the filter to the packet destination address (unless you also specify Drop If Next Hop Is Unreachable).

- Forward to First Up Next Hop Interface

  Specifies that any frame that matches the filter will be forwarded to a specified next-hop router or to a network connected to the router. If the specified hop is not reachable, the filter tries all addresses on the next-hop interfaces list using ARP messages. If none of the next-hop interfaces is reachable, the router forwards packets that match the filter to the packet destination address (unless you also specify Drop If Next Hop Is Unreachable).

- Detailed Logging

  For every packet that matches the filter criteria and ranges, the filter adds an entry containing IP header information to the system Events log.

IPX Criteria and Actions

You filter inbound IPX traffic based on specified bit patterns in the IPX header.

Predefined IPX Criteria

Table 3-7 lists the predefined criteria for IPX inbound traffic filters, and the reference field, offset, and length for each criterion.

Table 3-7. Predefined Criteria for IPX Inbound Traffic Filters

Criterion Name	Reference Field	Offset	Length
Destination Network	IPX_BASE	48	32
Destination Address	IPX_BASE	80	48
Destination Socket	IPX_BASE	128	16
Source Network	IPX_BASE	144	32
Source Address	IPX_BASE	176	48
Source Socket	IPX_BASE	224	16

User-Defined IPX Criteria

In addition to the predefined filter criteria, you can create traffic filters with user-defined criteria by specifying an offset and length to this reference field in the IPX header:

Reference Field	Description
IPX_BASE	Points to the first byte in the IPX header

IPX Actions

The IPX filtering actions are Accept, Drop, and Log.

LLC2 Criteria and Actions

You can filter inbound LLC2 traffic based on specified bit patterns in the LLC2 header.

Adding an IBM protocol to a circuit automatically adds LLC2. LLC2 traffic filters apply to LLC2 routed over Frame Relay (also known as native SNA over Frame Relay) and to any protocol running over LLC2, including Advanced Peer-to-Peer Networking (APPN) and LAN Network Manager (LNM).

Predefined LLC2 Criteria

Table 3-8 lists the predefined criteria for LLC2 inbound traffic filters, and the reference field, offset, and length for each criterion.

Table 3-8. Predefined Criteria for LLC2 Inbound Traffic Filters

Criterion Name	Reference Field	Offset	Length
Destination MAC Address	LLC2_DEST_MAC	0	48
Source MAC Address	LLC2_SOURCE_MAC	48	48
DSAP	LLC2_DSAP	0	8
SSAP	LLC2_SSAP	8	8

User-Defined LLC2 Criteria

In addition to the predefined LLC2 criteria, you can create traffic filters with user-defined criteria by specifying an offset and length to these reference fields in the LLC2 header:

Reference Field	Description
LLC2_DEST_MAC	Points to the first byte of the Destination MAC Address
LLC2_DSAP	Points to the first byte of the Destination SAP (DSAP)

LLC2 Actions

The LLC2 filtering actions are Accept, Drop, and Log.

OSI Criteria and Actions

You can configure OSI inbound traffic filters based on specified bit patterns in the Connectionless Network Protocol (CLNP) header.

Predefined OSI Criteria

Table 3-9 lists the predefined criteria for OSI inbound traffic filters, and the reference field, offset, and length for each criterion.

Table 3-9. Predefined Criteria for OSI Inbound Traffic Filters

Criterion Name	Reference Field	Offset	Length
Destination Area	OSI_DEST	0	16
Destination System ID	OSI_DEST	16	48
Source Area	OSI_SRC	0	16
Source System ID	OSI_SRC	16	48

User-Defined OSI Criteria

In addition to the predefined OSI filter criteria, you can create traffic filters with user-defined criteria by specifying an offset and length to these reference fields in the CLNP header:

Reference Field	Description
OSI_BASE	Points to the first byte of the CLNP header
OSI_DEST	Points to the last two bytes of the OSI_DEST reference field
OSI_SRC	Points to the last two bytes of the OSI_SRC reference field

OSI Actions

The OSI filtering actions are Accept, Drop, and Log.

VINES Criteria and Actions

You can filter inbound VINES traffic based on specified bit patterns in the VINES header.

Predefined VINES Criteria

Table 3-10 lists the predefined criteria for VINES inbound traffic filters, and the reference field, offset, and length for each criterion.

Table 3-10. Predefined Criteria for VINES Inbound Traffic Filters

Criterion Name	Reference Field	Offset	Length
Protocol Type	VINES_BASE	40	8
Destination Address	VINES_BASE	48	48
Source Address	VINES_BASE	96	48

User-Defined VINES Criteria

In addition to the predefined VINES filter criteria, you can create traffic filters with user-defined criteria by specifying an offset and length to this reference field in the VINES header:

Reference Field	Description
VINES_BASE	Points to the first byte in the VINES header

VINES Actions

The VINES filtering actions are Accept, Drop, and Log.

XNS Criteria and Actions

You can filter inbound XNS traffic based on specified bit patterns in the XNS header.

Predefined XNS Criteria

Table 3-11 lists the predefined criteria for XNS inbound traffic filters, and the reference field, offset, and length for each criterion.

Table 3-11. Predefined Criteria for XNS Inbound Traffic Filters

Criterion Name	Reference Field	Offset	Length
Destination Network	XNS_BASE	48	32
Destination Address	XNS_BASE	80	48
Destination Socket	XNS_BASE	128	16
Source Network	XNS_BASE	144	32
Source Address	XNS_BASE	176	48
Source Socket	XNS_BASE	224	16

User-Defined XNS Criteria

In addition to the predefined filter criteria, you can create traffic filters with user-defined criteria by specifying an offset and length to this reference field in the XNS header:

Reference Field	Description
XNS_BASE	Points to the first byte in the XNS header

XNS Actions

The XNS filtering actions are Accept, Drop, and Log.

Chapter 4
Outbound Traffic Filter Criteria and Actions

You create outbound traffic filters using templates that consist of criteria, ranges, and actions. To define a template, you need to know the specific criteria and actions that Site Manager supports for outbound traffic filters.

This chapter lists the following:

- Predefined outbound traffic filter criteria and actions
- Reference points for user-defined criteria

Topic	Page
Selecting Predefined Criteria	4-2
Selecting User-Defined Criteria	4-7
Selecting Actions	4-10

For an overview of traffic filters, templates, and their criteria, ranges, and actions, see Chapter 1. For instructions on using Site Manager to create outbound traffic filters, see Chapter 7.

Note: For information about DLSw outbound traffic filters, see *Configuring DLSw Services*.

Selecting Predefined Criteria

Outbound traffic filter criteria are based on the data link header or IP header.

- For bridged traffic, you use predefined criteria based on the data link header.
- For IP-routed traffic, you use predefined criteria based on the IP header.
- For most WAN and LAN routing protocols, you can use predefined criteria based on either the data link header *or* the IP header.
- For NetBIOS, SNA, and other DLSw-encapsulated traffic, you use predefined outbound traffic filter criteria based on the DLSw protocol header. For information about DLSw outbound traffic filters, see *Configuring DLSw Services*.

This section covers the following topics:

- Predefined Data Link Criteria
- Predefined IP Criteria
- Specifying Criteria Common to IP and Data Link Headers

Predefined Data Link Criteria

You can configure outbound traffic filters based on the predefined data link criteria listed in Table 4-1.

Table 4-1. Predefined Data Link Criteria for Outbound Traffic Filters

Packet Component	Predefined Criteria
Data link header (Data Link Type)	MAC Source Address MAC Destination Address Ethernet Type Novell 802.2 Length 802.2 DSAP 802.2 SSAP 802.2 Control 802.2 SNAP Length 802.2 SNAP Protocol ID 802.2 SNAP Ethernet Type (Ethertype)

(continued)

Table 4-1. Predefined Data Link Criteria for Outbound Traffic Filters *(continued)*

Packet Component	Predefined Criteria
SRB	DSAP SSAP
PPP	Protocol ID
Frame Relay	2-byte DLCI 3-byte DLCI 4-byte DLCI NLPID Ethernet Type (Ethertype)

Figure 4-1 shows the Configuration Manager menu path for specifying these criteria. See Chapter 7 for detailed instructions on creating outbound filters.

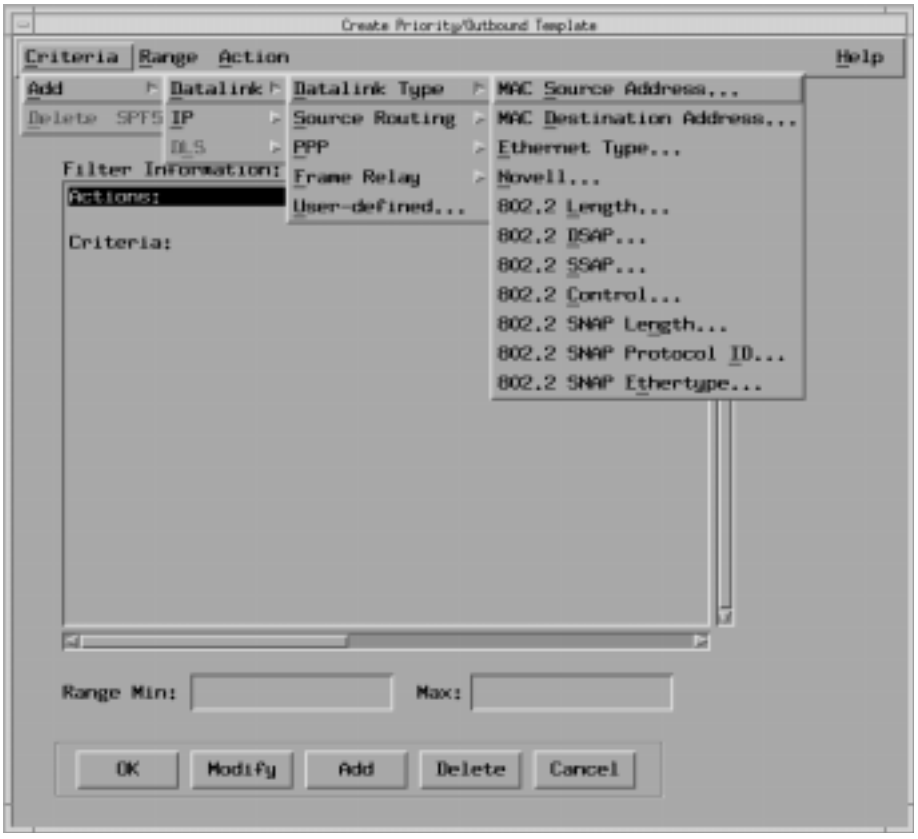

Figure 4-1. Predefined Data Link Criteria for Outbound Traffic Filters

Predefined IP Criteria

You configure outbound traffic filters for routing protocols based on the predefined criteria listed in Table 4-2.

Table 4-2. Predefined IP Criteria for Outbound Traffic Filters

Packet Type or Component	Predefined Criteria
IP header	Type of Service IP Source Address IP Destination Address Both Source Address *and* Destination Address UDP Source Port UDP Destination Port TCP Source Port TCP Destination Port TCP *or* UDP Source Port TCP *or* UDP Destination Port Established TCP Port Protocol
SRB	MAC Destination Address MAC Source Address SSAP DSAP
PPP	Protocol ID
Frame Relay	2-byte DLCI 3-byte DLCI 4-byte DLCI NLPID

You can assign as many as 31 outbound traffic filters with IP criteria to an interface. Figure 4-2 shows the Configuration Manager menu path for specifying these criteria. See Chapter 7 for detailed instructions on using Configuration Manager to create outbound traffic filters.

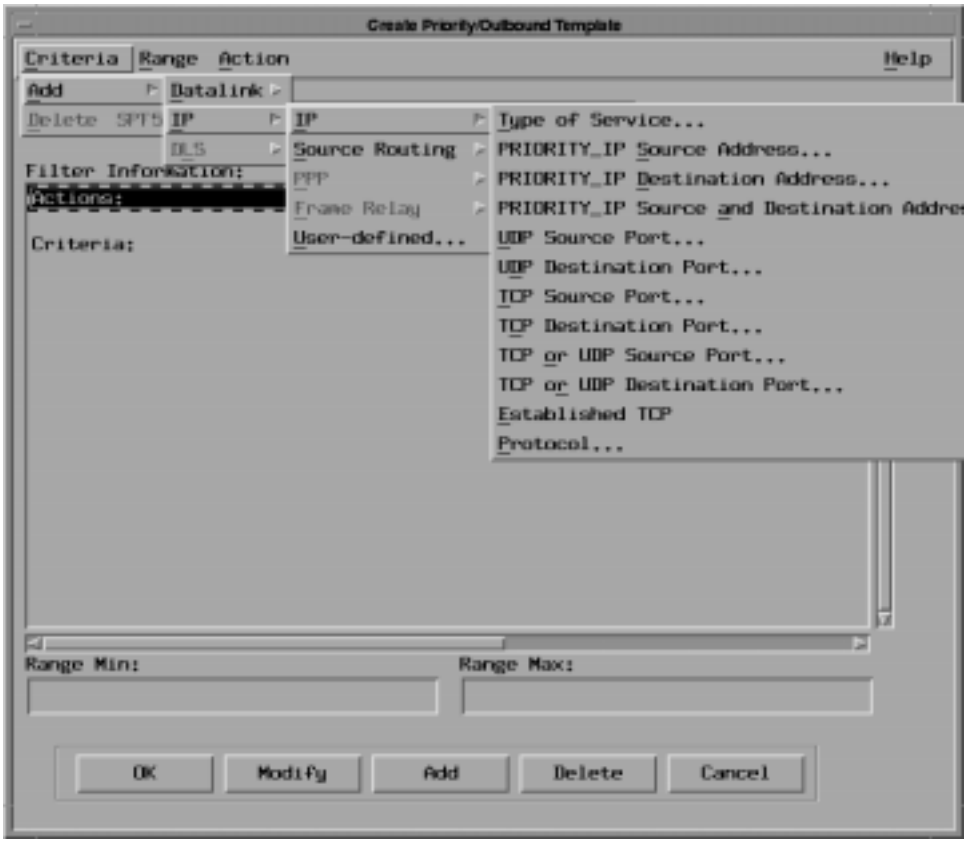

Figure 4-2. Predefined IP Criteria for Outbound Traffic Filters

Specifying Criteria Common to IP and Data Link Headers

Several predefined outbound traffic filter criteria are common to both the IP and data link headers, such as the PPP Protocol ID, SRB SSAP/DSAP, and Frame Relay DLCI and NLPID criteria.

To configure outbound traffic filters for IP-routed packets, always select IP instead of Datalink when choosing the criterion. If you create a filter using a data link criterion to identify an IP-routed packet (for example, using the Ethertype range of 0x0800 or the Protocol ID of 0x0021), the filter does not work because the router code recognizes the IP-routed packet and expects IP filter rules.

To configure criteria for both IP and data link reference points, you create two filters: one with the IP criterion and the other with the Datalink criterion. For example, if you want to prioritize Frame Relay traffic with data link connection identifier (DLCI) 400 in the High queue, create filters for both the IP and Datalink DLCI criterion, using a range value of 400.

Selecting User-Defined Criteria

To create a filter with a user-defined criterion, you specify the offset and length to a supported reference point in the data link or IP packet header. This section describes the following reference points for specifying user-defined outbound traffic filter criteria:

- Data Link Reference Points
- IP Reference Points

Data Link Reference Points

Table 4-3 defines the reference points in the data link header from which you can build user-defined criterion

Table 4-3. Data Link Reference Points

Reference Point	Definition
MAC	Points to the high-order byte of the destination address
DATA_LINK	Points to the first byte following the length/type criteria
DL_HEADER_START	Points to the beginning of the header (beginning of the packet) for PPP and Frame Relay packets
DL_HEADER_END	Points to the first byte following the DLCI in a Frame Relay packet, and the first byte following the protocol ID in a PPP packet
DL_FR_MPE	Points to the NLPID (Frame Relay packets only)
DL_SR_START	Points to the beginning of the SRB packet, which is the high-order byte of the destination address
DL_SR_DATA_LINK	Points to the first byte following the RIF

Figures 4-3 and 4-4 show examples of where these reference points are located in a packet.

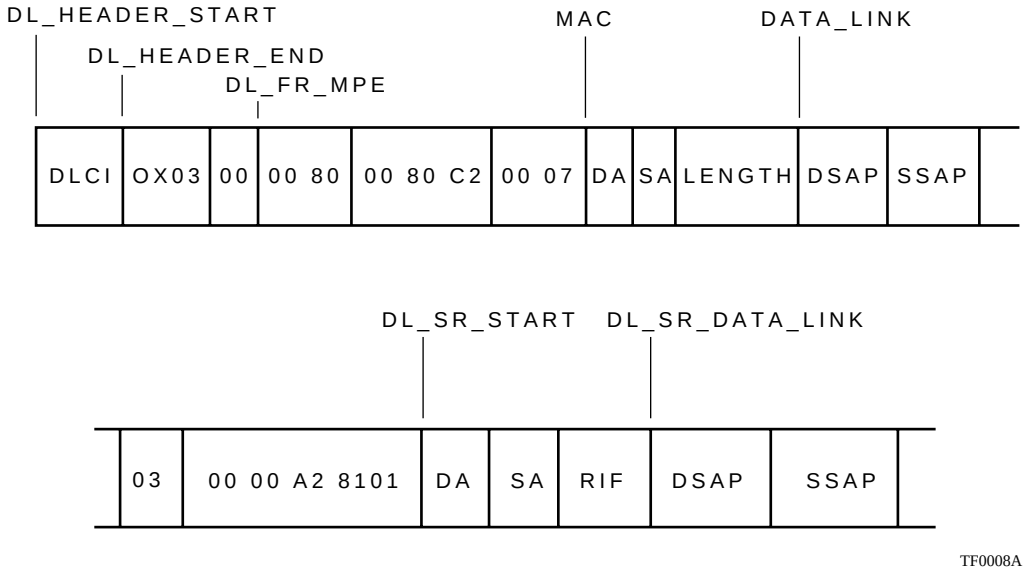

Figure 4-3. Data Link Reference Points in an SRB Packet Bridged over Bay Networks Proprietary Frame Relay

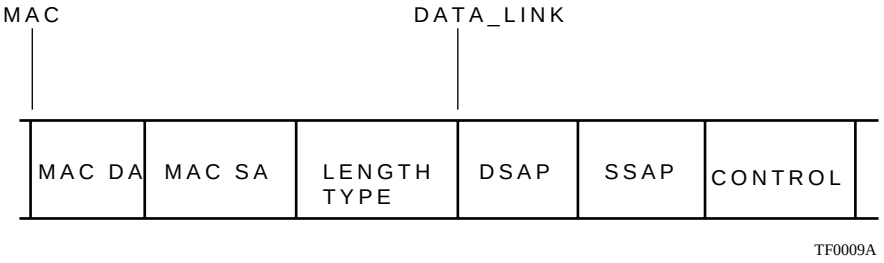

Figure 4-4. Data Link Reference Points in an IEEE 802.2 LLC Header

IP Reference Points

Table 4-4 defines the reference points in the IP header from which you can build user-defined criterion. Figure 4-5 shows an example of where those reference points are located in a packet.

Table 4-4. IP Reference Points

Reference Point	Definition
HEADER_START	Points to the first byte in the IP header
HEADER_END	Points to the first byte following the IP header
IP_WAN_HEADER_START	Points to the beginning of the header (beginning of the packet) for PPP and Frame Relay packets
IP_WAN_HEADER_END	Points to the first byte following the DLCI in a Frame Relay packet, and the first byte following the protocol ID in a PPP packet
IP_SR_START	Points to the beginning of the SRB packet, which is the high-order byte of the destination address
IP_SR_DATA_LINK	Points to the first byte following the RIF

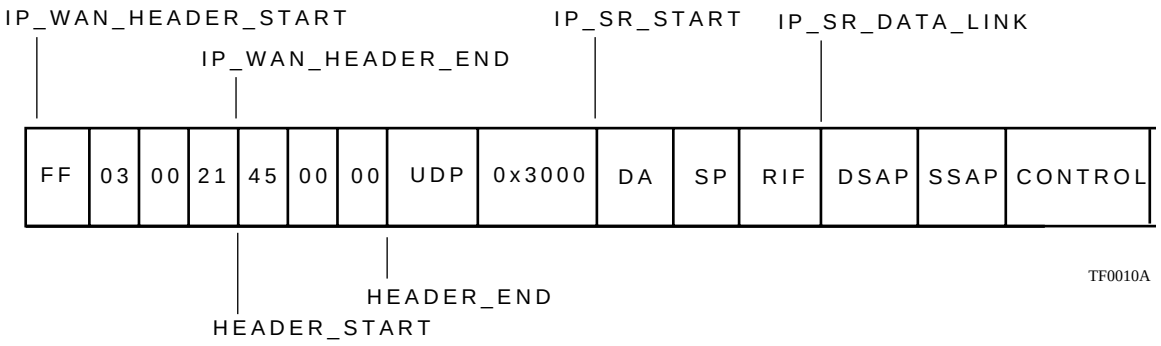

Figure 4-5. IP Reference Points in an IP-Encapsulated SRB Packet Bridged over PPP

Selecting Actions

For outbound traffic filters, you can specify different types of actions:

- Filtering Actions
- Prioritizing Actions
- Dial Service Actions

Filtering Actions

You can apply the following actions to an outbound traffic filter:

- Accept

  The router processes any packet that matches the filter criteria and ranges.

- Drop

  The router does not route any packet that matches the filter criteria and ranges.

- Log

  For every packet that matches the filter criteria and ranges, the router sends an entry to the system Events log. You can specify the Log action in combination with other actions.

- Detailed Log

  For every packet that matches the filter criteria and ranges, the router adds a more-detailed entry to the system Events log, containing IP header information.

Note: Specify the Log actions to record abnormal events only; otherwise, the Events log will fill up with filtering messages, leaving no room for critical log messages.

Prioritizing Actions

You can apply the following actions to outbound traffic filters for WAN protocols:

- High

  Directs packets that match the filter criteria and ranges to the High queue

- Low

  Directs packets that match the filter criteria and ranges to the Low queue

- Length

  Uses the length of packets to determine the priority queue

Outbound traffic filters with a prioritizing action are called *priority filters.*

Note: You can apply prioritizing actions only to MCE1, MCT1, and synchronous interfaces. The Configuration Manager does not support priority filters on the LAN interfaces.

See Chapter 2 for detailed information about protocol prioritization.

Dial Service Actions

You can apply the following actions to outbound traffic filters for interfaces configured as dial-up lines:

- No Call

  Packets that match the filter criteria and ranges are dropped and do not initiate a dial connection. (By default, packets transmitted on dial-on-demand lines always trigger the router to establish a connection.)

- No Reset

  Packets that match the filter criteria and ranges are processed but do not reset the inactivity timer.

Note: Although No Call and No Reset are available when creating any outbound traffic filter, these actions are useful only on dial-up interfaces such as synchronous modem lines or MCT1 interfaces configured with ISDN PRI.

You can use the dial service actions to configure outbound traffic filters that specify or reduce the type of traffic that initiates dial connections.

For example, you can use dial service actions to configure a dial-on-demand interface to exchange IP RIP and IPX RIP/SAP routing updates only when the router initiates connections for *data* transmission. This reduction in update-only traffic, called *dial optimized routing*, prevents unnecessary connections and reduces line costs.

See *Configuring Dial Services* for information about dial services such as dial-on-demand and dial optimized routing.

Chapter 5
Specifying Common Criterion Ranges

For every inbound or outbound traffic filter criterion, you must specify a valid *range* -- a series of target values appropriate for the criterion. For many criteria, you specify an address range.

This chapter explains how to specify common address ranges and lists valid ranges.

Topic	Page
Specifying MAC Address Ranges	5-2
Specifying VINES Address Ranges	5-3
Specifying Source and Destination SAP Code Ranges	5-4
Specifying Frame Relay NLPID Ranges	5-5
Specifying PPP Protocol ID Ranges	5-5
Specifying TCP and UDP Port Ranges	5-6
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Specifying MAC Address Ranges

When you create a traffic filter that includes a Source or Destination MAC Address criterion, you specify the MAC address range in either canonical format or most significant bit (MSB) format. Table 5-1 lists the MAC address formats.

Table 5-1. Format for Specifying MAC Addresses

Address Type	Address Format
PPP	MSB
Bay Networks Standard Frame Relay	Canonical
Bay Networks Proprietary PPP	Canonical
Token ring	MSB*
Ethernet	Canonical

* For example, to drop the address 0x123456789ABC, specify the filter range in bit-swapped format: 0x482C6A1E593D.

The following sections provide information about specifying SRB source MAC addresses and functional MAC addresses.

SRB Source MAC Addresses

Consider the following when specifying source MAC addresses for SRB traffic filters:

- Set the MSB to 1 by adding the First Bit Set MAC Address (0x800000000000) to the source MAC address.

  For example, to filter token ring packets with the source MAC address of 0x400037450440, first add 0x800000000000. Then, specify the result, 0xC00037450440, as the criteria range.

- If you use a sniffer to analyze packets for their source MAC address, keep in mind that the routing information indicator (RII) is set to 1 if the routing information field (RIF) is present, and is set to 0 if there is no RIF.

  Bit 0 (the 0x80 bit) of byte 0 (the leftmost byte) is the RII bit, which indicates the presence of the RIF bit. For example, a sniffer decodes LAA with the first byte of 40 as 0x400031740001. If the RIF bit is set, the hexadecimal value of the packet is 0xC00031740001.

SRB Functional MAC Addresses

Functional MAC addresses are destination MAC addresses that always conform to the following rules:

- Byte 0 = 0xC0
- Byte 1 = 0x00
- The first half of byte 2 = 0x0 to 0x7

Table 5-2 lists some common functional MAC addresses.

Table 5-2. Functional MAC Addresses

Function Name	MAC Address (MSB)	Identifying Bit	Ethernet Address
Active Monitor	0xC000 0000 0001	Byte 5, bit 7	0x030000000080
Ring Parameter Server	0xC000 0000 0002	Byte 5, bit 6	0x030000000040
Ring Error Monitor	0xC000 0000 0008	Byte 5, bit 4	0x030000000010
Configuration Report Server	0xC000 0000 0010	Byte 5, bit 3	0x030000000008
NetBIOS	0xC000 0000 0080	Byte 5, bit 0	0x030000000001
Bridge	0xC000 0000 0100	Byte 4, bit 7	0x030000008000
LAN Manager	0xC000 0000 2000	Byte 4, bit 2	0x030000000400
User-defined	0xC000 0008 0000 to 0xC000 4000 0000	Byte 3, bits 0-4; Byte 2, bits 1-7	0x030000100000 to 0x030002000000

Specifying VINES Address Ranges

You specify VINES server address ranges in hexadecimal format. For example, if the address of a VINES server is **a2482c.0001**, convert the value to hexadecimal and specify the filter criteria range as **0xa2482c0001**.

You can obtain a VINES server address as follows:

- From a sniffer trace
- By using the Technician Interface to obtain the value of the *wfVinesIfEntry.wfVinesIfAdr* MIB object

Specifying Source and Destination SAP Code Ranges

Table 5-3 lists some common SAP codes. The SAP code consists of a 7-bit SAP address and a 1-bit Command/Response field.

Table 5-3. SAP Codes

SAP Code	Description
00-01*	XID or TEST
02	Individual Sublayer Management
03	Group Sublayer Management
04-05, 08-09, 0C-0D	SNA
06	IP
0E	Proway Network Management
10	Novell and SDLC Link Servers
20, 34, EC	CLNP ISO OSI
42	BPDU
7E	X.25 over 802.2 LLC2
80	XNS
86	Nestar
8E	Active Station List
98	ARP
AA	SNAP
BC	Banyan VIP
E0	Novell IPX
F0	IBM NetBIOS
F4, F5	LAN Network Manager
F8	Remote Program Load
FC	IBM RPL
FE	ISO Network Layer
FF	LLC Broadcast

* The Command/Response bit makes the 0x00 byte look like 0x01.

Use these values to specify a range for any Source or Destination SAP traffic filter criteria.

Specifying Frame Relay NLPID Ranges

Table 5-4 lists some common Frame Relay network layer protocol ID (NLPID) values. You use these values to specify ranges for NLPID criteria in an outbound traffic filter.

Table 5-4. Frame Relay NLPIDs

NLPID (0x)	Description
CC*	IP
81, 82, 83	OSI
80	SNAP

* Use this value only to specify ranges for the criterion selected by choosing Criteria > Add > IP > Frame Relay > NLPID on the Create Priority/Outbound Template window. Do not use a data link criterion to specify IP traffic.

Specifying PPP Protocol ID Ranges

Table 5-5 lists some common PPP protocol ID values. See RFC 1700 for a complete list. You use these values to specify ranges for Protocol ID criteria in an outbound traffic filter.

Table 5-5. PPP Protocol IDs

Protocol ID (0x)	Description
0021*	IP
0023	OSI
0033	Stream Protocol (ST2)

* Use this value only to specify ranges for the criterion selected by choosing Criteria > Add > IP > PPP > Protocol ID on the Create Priority/Outbound Template window. Do not use a data link criterion to specify IP traffic.

Specifying TCP and UDP Port Ranges

Table 5-6 lists some common TCP port values to use when specifying TCP source or destination port ranges in inbound or outbound IP traffic filters.

Table 5-6. Source and Destination TCP Ports

Description	TCP Port
FTP	20, 21
Telnet	23
SMTP	25
DNS	53
Gopher	70
World Wide Web http	80 to 84
DLSw Read Port	2065
DLSw Write Port	2067

Table 5-7 lists some common UDP port values to use when specifying UDP source or destination port ranges in inbound or outbound IP traffic filters.

Table 5-7. Source and Destination UDP Ports

Description	UDP Port
DNS	53
TFTP	69
SNMP	161
SNMPTRAP	162

Specifying Ethernet Type Ranges

Table 5-8 lists some common Ethernet Type codes to use when specifying Ethertype ranges in inbound or outbound traffic filters. See RFC 1700 for a complete list.

Table 5-8. Ethernet Type Codes

Description	Ethernet Type or Ethertype Code (0x)
Bay Networks Synchronous Pass-Through	80FF
Bay Networks Source Route Traffic (non-Token Ring media)	8101
Bay Networks Breath of Life Packet (BofL)	8102
Bay Networks Transparent Bridge Traffic on Token Ring	8103
Bridged Ethernet over RFC 1490 Frame Relay	0007
Bridged Token Ring over RFC 1490 Frame Relay	0009
Bridged FDDI over RFC 1490 Frame Relay	000A
Bridged PDUs over RFC 1490 Frame Relay	000B
802.3 Length Field	0000-05EE
802.5 Length Field	0000-05FF
Xerox PUP	0101-01FF, 0200, 0201
Nixdorf	0400
XNS (IDP)	0600
XNS (Address Translation)	0601
IP	0800
X.25	0801
CHAOSnet	0804
X.25 Level 3	0805
ARP	0806
XNS	0807
Symbolix	081C
Xyplex	0888-088A
UB Debugger	0900
XNS Address Translation	0A00-0A01

(continued)

Table 5-8. Ethernet Type Codes *(continued)*

Description	Ethernet Type or Ethertype Code (0x)
Banyan VINES	0BAD
DEC	6000-6009
DEC MOP	6001-6002
DRP	6003
DEC LAT	6004
LAVC	6007
3COM	6010-6014
UB Download	7000
UB NUI	7001
UB Boot Broadcast	7002
Proteon	7030
Cabletron	7034
Cronous	8003-8004
HP Probe	8005
Nestar	8006
Excelan	8010
Silicon Graphics	8013, 8014, 8015
HP Apollo Native Ethernet	8019
RARP	8035
DEC BPDU	8038
DEC	8039-8042
DEC Encryption	803D
DEC LAN Traffic Monitor	803F
DEC NetBIOS Emulator	8040
AT&T	8046-8047
Compugraphic	8069
Vitalink Management	807D-8080
Xyplex	8088-808A
Kinetics Ether-talk	809B

(continued)

Table 5-8. Ethernet Type Codes *(continued)*

Description	Ethernet Type or Ethertype Code (0x)
Spider	809F
Nixdorf	80A3
Siemens	80A4-80B3
Pacer Software	80C6
Applitek	80C7
Intergraph	80C8-80CC
Harris 3M	80CD-80CE
IBM SNA	80D5
Retix Bridge Management	80F2
AARP	80F3
Shiva	80F4
HP Apollo	80F7
Symbolics	8107-8109
Waterloo Software	8130
IPX over Frame Relay	8137
Novell	8137-8138
DEC MOP	9000
XNS Bridge Comm Management	9001
3Com	9002-9003

Specifying IP Protocol ID and Type of Service Ranges

The Internet Protocol version 4 (IPv4) specifies an 8-bit Protocol field to identify the next-level protocol. Table 5-9 lists some common Protocol ID codes for IP traffic. Table 5-10 lists IP Type of Service codes. See RFC 1700 for information.

Table 5-9. IP Protocol ID Codes

Description	Protocol ID Code (decimal)
ICMP (Internet Control Message Packets)	1
IGP (Interior Gateway Protocol)	9
RSVP (Reservation Protocol)	46
VINES	83
OSPF	89

Table 5-10. IP Type of Service Codes

Description	Type of Service Code
Network Control	111
Internetwork Control	110
CRITIC/ECP	101
Flash Override	100
Flash	011
Immediate	010
Priority	001
Routine	000

You use these codes to specify ranges for Protocol or Type of Service criteria in inbound or outbound IP traffic filters. Select these criteria as follows:

- **For an inbound traffic filter** -- In either the Create IP Template or Edit IP Filters window, choose Criteria > Add > IP > Type of Service │ Protocol ID.
- **For an outbound traffic filter** -- In either the Create Priority/Outbound Template window or Edit Priority/Outbound Filters window, choose Criteria > Add > IP > IP > Type of Service │ Protocol.

Chapter 6
Applying Inbound Traffic Filters

This chapter describes how to use the Configuration Manager to configure inbound traffic filters.

Topic	Page
Displaying the Inbound Traffic Filters Window	6-2
Preparing Inbound Traffic Filter Templates	6-3
Creating an Inbound Traffic Filter	6-10
Editing an Inbound Traffic Filter	6-11
Enabling or Disabling an Inbound Traffic Filter	6-15
Deleting an Inbound Traffic Filter	6-16
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To complete the procedures in this chapter, you must be familiar with protocol-specific filtering criteria and actions. See Chapter 3 for this information.

Displaying the Inbound Traffic Filters Window

To apply inbound traffic filters to a particular interface, you first display the Filters window for the protocol you are filtering.

To display the Filters window for all protocols *except* DLSw:

Site Manager Procedure	
You do this	**System responds**
1. Display the Configuration Manager window.	
2. Click on the circuit interface connector (for example, **COM1**, **XCVR2**).	The Edit Connector window opens.
3. Click on **Edit Circuit**.	The Circuit Definition window opens; the circuit you selected is highlighted.
4. Choose Protocols > Edit *protocol* > Traffic Filters. The menu path to the Filters window is protocol specific.	The Filters window for the selected circuit and protocol opens (Figure 6-1).

To display the Filters window for DLSw:

Site Manager Procedure	
You do this	**System responds**
1. Display the Configuration Manager window.	
2. Choose Protocols > DLSw > Traffic Filters (Inbound).	The DLS Filters window opens.

Although the Filters window is protocol specific, you use it the same way for all protocols. Figure 6-1 shows the Bridge Filters window.

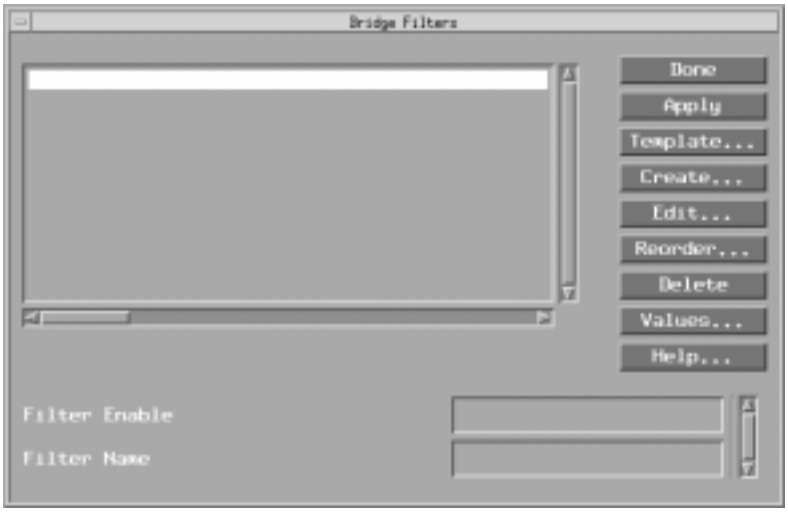

Figure 6-1. Inbound Traffic Filters Window

Preparing Inbound Traffic Filter Templates

To add an inbound traffic filter to a router interface, you apply a protocol-specific traffic filter template to the circuit. However, you do not always need to create a template; often, you can begin with an existing template. This section describes how to prepare an inbound traffic filter template by:

- Creating a Template
- Customizing Templates

See "Creating an Inbound Traffic Filter" later in this chapter to learn how to create the filter by applying (saving) a filter template to an interface.

Creating a Template

To create an inbound traffic filter template:

Site Manager Procedure	
You do this	**System responds**
1. Display the Filters window (Figure 6-1). See "Displaying the Inbound Traffic Filters Window."	
2. Click on **Template**.	The Filter Template Management window opens (Figure 6-2).
3. Click on **Create**.	The Create Template window for the protocol opens (Figure 6-3).
4. Specify a name for the new template in the Filter Name field. Use a descriptive name. For example, the name *Drop_Telnet* suggests the criterion and action to drop Telnet session requests from remote nodes.	
5. Choose Criteria > Add > *criterion*. See Chapter 3 for information about the criteria for your protocol. Each filter template can use only one criterion.	The Add Range window opens.
6. Specify a range for the selected criterion. To specify a hexadecimal number, use the prefix 0x. You must specify at least one range. If the range consists of just one value, specify that value in the Minimum value field. See Chapter 5 for information about common traffic filter ranges.	
7. Click on **OK**.	The Add Range window closes. The criterion and range appear in the Filter Information field of the Create Template window.
8. To add more ranges, choose Range > Add. Then, repeat steps 6 and 7. You can add up to 100 ranges for each criterion.	
9. Choose Action > Add > *action*.	
10. Click on **OK**.	The Filter Template Management window opens (Figure 6-2). The template appears in the templates list.

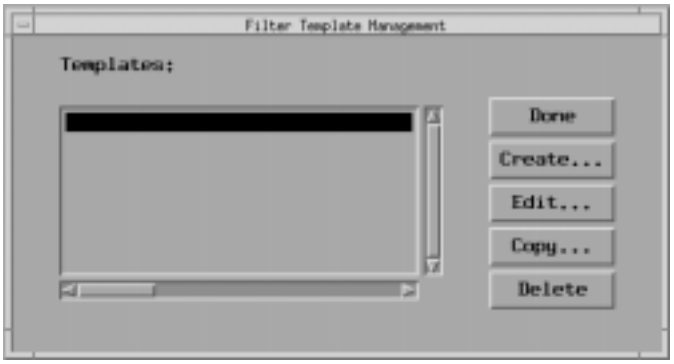

Figure 6-2. Filter Template Management Window

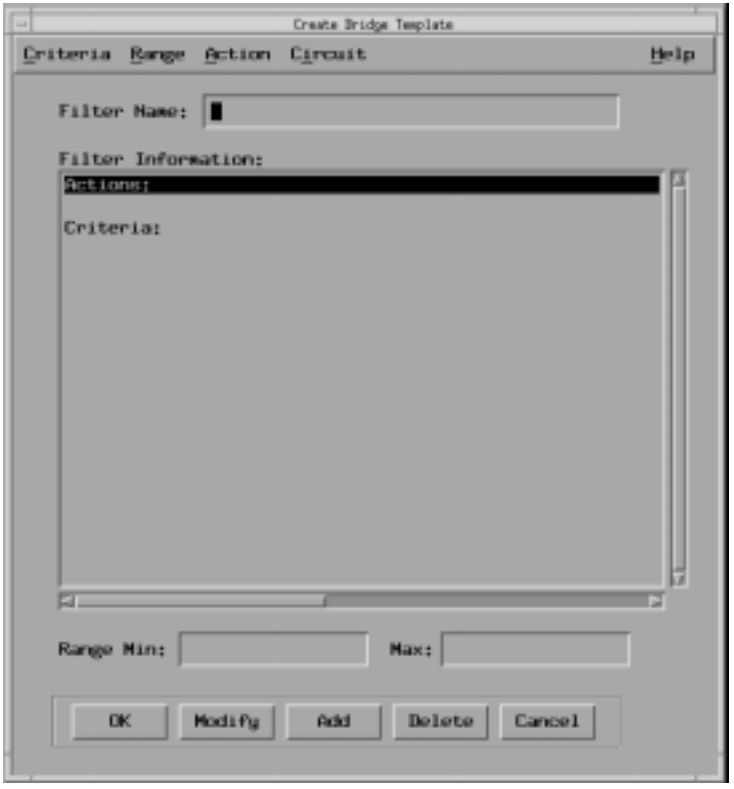

Figure 6-3. Create Template Window

Customizing Templates

There are two ways to customize a filter template:

- Copy an existing template, rename it, and then edit it.

  This preserves the original template and creates an entirely new template with the same criteria and actions. You can then modify the new template to suit your needs.

- Edit an existing template.

  If you do not need to preserve the original template, you can edit it without first copying and renaming it. (Changing a template does not affect interfaces to which the template has already been applied.)

Note: You can also edit or copy a template using a text editor. The Configuration Manager stores all templates in the file *template.flt*.

Copying a Template

To duplicate an existing template:

Site Manager Procedure	
You do this	**System responds**
1. Display the Filters window (Figure 6-1). See “Displaying the Inbound Traffic Filters Window.”	
2. Click on **Template**.	The Filter Template Management window opens (Figure 6-2).
3. Select a template.	
4. Click on **Copy**.	The Copy Filter Template window opens.
5. Specify a name for the new template. Be sure to use a name that reflects its contents.	
6. Click on **OK**.	The Filter Template Management window opens. The new template appears in the templates list.

Editing a Template

After you create or copy a template, edit it as follows:

Site Manager Procedure	
You do this	**System responds**
1. Select a template in the Filter Template Management window.	
2. Click on **Edit**.	The Edit Template window for the protocol opens (Figure 6-4).
3. Add or delete predefined criteria, ranges, and actions (Table 6-1).	
4. Click on **OK**.	The Filter Template Management window opens (Figure 6-2).
5. Click on **Done**.	The Filters window opens (Figure 6-1).

Table 6-1 describes how to add, delete, or modify predefined criteria, ranges, and actions in the Edit Template window (Figure 6-4).

To add a user-defined criterion, see "Specifying User-Defined Criteria" later in this chapter.

Figure 6-4. Edit Template Window

Table 6-1. Using the Edit Template Window

Task	Site Manager Procedure	Notes
Add a criterion	1. Choose Criteria > Add > *criterion*. The Add Range window opens.	A template can have only one criterion. You must specify at least one range in a template.
	2. Type a range in the Minimum value and Maximum value fields, then click on **OK**.	
Delete a criterion	1. Select the criterion to delete in the Filter Information field.	A template must have a criterion. Specify a new criterion after deleting one.
	2. Click on **Delete**. The Delete Criteria window opens.	
	3. Click on **Delete**.	
Add a range	1. Select the criterion in the Filter Information field.	You can add up to 100 ranges. If the range consists of a single value, type the value in the Minimum value field only. Use the prefix 0x to specify a hexadecimal number. Zero is not a valid entry.
	2. Click on **Add**. The Add Range window opens.	
	3. Type a range in the Minimum value and Maximum value fields, then click on **OK**.	
Modify a range	1. Select the range to modify in the Filter Information field.	Ranges are listed below the criterion in the Filter Information field. Selected ranges appear in the Range Min and Range Max fields at the bottom of the Edit Template window.
	2. Click on **Modify**.	
	3. Type new values in the Range Min and Range Max fields.	
Delete a range	1. Select the range to delete in the Filter Information field.	You must specify at least one range for each criterion.
	2. Click on **Delete**. The Delete Range window opens.	
	3. Click on **Delete**.	
Add an action	1. Choose Action > Add > *action*.	With the exception of the Log action, each template has only one action.
Delete an action	1. Select an action in the Filter Information field.	You must specify at least one action in a template.
	2. Click on **Delete**. The Delete Action window opens.	
	3. Click on **Delete**.	
Save the template	1. Click on **OK**. The Filter Template Management window opens.	Be sure you have specified: • Only one criterion • Only one action • 1-100 ranges

Creating an Inbound Traffic Filter

You create an inbound traffic filter by applying a filter template to an interface.

Note: You should create the filters on an interface in order of precedence. The first filter you create has the highest precedence and a rule number of 1. Subsequent filters that you create have lower precedence. For more information, see "Changing Inbound Traffic Filter Precedence" later in this chapter.

To create an inbound traffic filter:

Site Manager Procedure	
You do this	**System responds**
1. Display the Filters window (Figure 6-1). See "Displaying the Inbound Traffic Filters Window."	
2. Click on **Create**.	The Create Filter window opens (Figure 6-5).
3. Select a circuit in the Interfaces field.	
4. Select a template in the Templates field. If the Templates field is empty, complete the steps in "Preparing Inbound Traffic Filter Templates."	
5. In the Filter Name field, specify a name for the new filter. It can be helpful to include the circuit name to differentiate the template from the filter. For example, specify *Drop_Telnet_S42* as the name of a filter that drops inbound Telnet traffic on the synchronous circuit S42.	
6. Click on **OK**.	The Filters window opens.

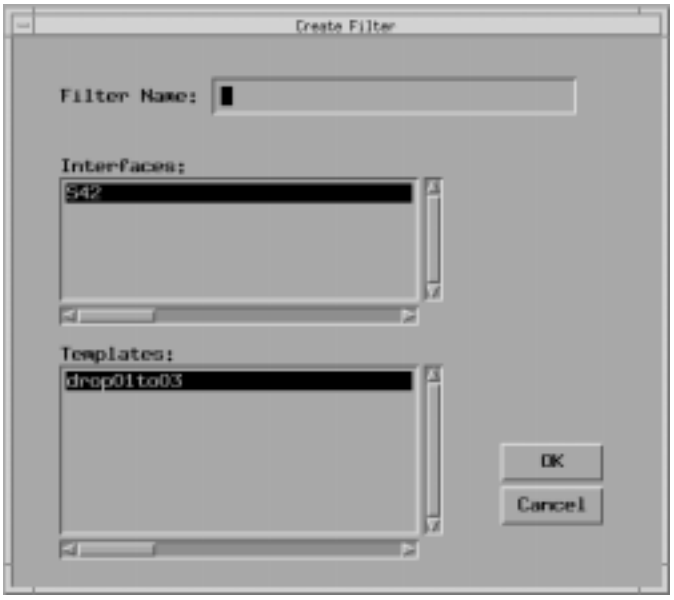

Figure 6-5. Create Filter Window

Editing an Inbound Traffic Filter

After you apply an inbound traffic filter to an interface, you can edit its criterion, ranges, or action. If you used a template that you edited to suit your needs, you may not need to make further edits.

When you customize a filter, you have the following options:

- Add or delete predefined criteria
- Add or delete user-defined criteria
- Add or delete actions
- Add, modify, or delete ranges

To add a user-defined criterion, see "Specifying User-Defined Criteria" later in this chapter.

To add predefined criteria, ranges, and actions, or delete any criterion, range, or action:

Site Manager Procedure	
You do this	**System responds**
1. Display the Filters window (Figure 6-1). See “Displaying the Inbound Traffic Filters Window.”	
2. Select a filter.	
3. Click on **Edit**.	The Edit Filters window opens (Figure 6-6).
4. Add or delete predefined criteria, ranges, and actions (Table 6-2).	
5. Click on **OK**.	The Filters window opens.

Table 6-2 describes how to add, delete, or modify predefined criteria, ranges, and actions in the Edit Filters window (Figure 6-6).

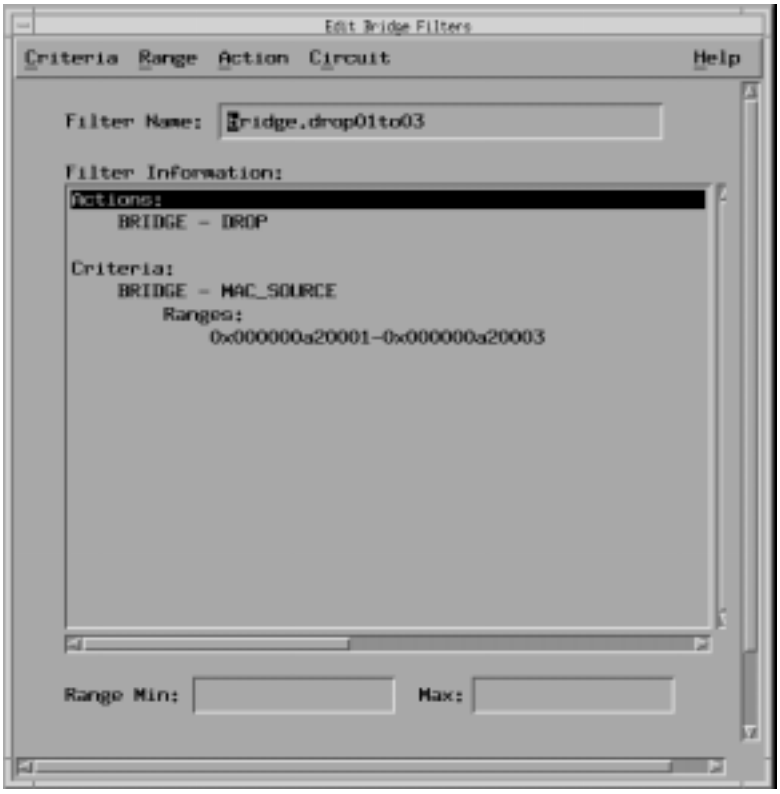

Figure 6-6. Edit Filters Window

Table 6-2. Using the Edit Filters Window

Task	Site Manager Procedure	Notes
Add a criterion	1. Choose Criteria > Add > *criterion*. The Add Range window opens. 2. Type a range in the Minimum value and Maximum value fields, then click on **OK**.	A filter can have only one criterion. You must specify at least one range for the filter.
Delete a criterion	1. Select the criterion to delete in the Filter Information field. 2. Click on **Delete**. The Delete Criteria window opens. 3. Click on **Delete**.	A filter must have a criterion. Specify a new criterion after deleting one.
Add a range	1. Select the criterion in the Filter Information field. 2. Click on **Add**. The Add Range window opens. 3. Type a range in the Minimum value and Maximum value fields, then click on **OK**.	You can add up to 100 ranges. If the range consists of a single value, type the value in the Minimum value field only. Use the prefix 0x to specify a hexadecimal number. Zero is not a valid entry. Selected ranges appear in the Range Min and Max fields at the bottom of the Edit Filters window.
Delete a range	1. Select the range to delete in the Filter Information field. 2. Click on **Delete**. The Delete Range window opens. 3. Click on **Delete**.	You must specify at least one range for each criterion.
Add an action	1. Choose Action > Add > *action*.	With the exception of the Log action, each filter has only one action.
Delete an action	1. Select an action in the Filter Information field. 2. Click on **Delete**. The Delete Action window opens. 3. Click on **Delete**.	You must specify at least one action in a filter.
Apply the changes	1. Click on **OK**. The Filters window opens. 2. Click on **Apply**.	Be sure you have specified: • Only one criterion • Only one action • 1-100 ranges

Enabling or Disabling an Inbound Traffic Filter

There may be times when you want to turn off a filter temporarily. Instead of deleting a filter from a circuit, you can disable the filter and then reenable it later.

To disable or reenable an inbound traffic filter:

Site Manager Procedure	
You do this	**System responds**
1. Display the Filters window (Figure 6-1). See “Displaying the Inbound Traffic Filters Window.”	
2. Select the filter to disable or enable.	The Filter Enable and Filter Name fields show the current status of the selected filter.
3. Click on **Values**.	The Values Selection window opens.
4. To disable the filter, select Disabled. To enable the filter, select Enabled.	
5. Click on **OK**.	The Values Selection window closes. The Filter Enable field in the Filters window indicates the change.
6. Click on **Apply**.	The filter’s action is now disabled or enabled.

Deleting an Inbound Traffic Filter

Deleting an inbound traffic filter permanently removes the filter from the circuit, but does not affect the template used to create the filter.

Note: Instead of deleting a filter, you may want to turn off the filter temporarily. You can do this by disabling the filter on a circuit. See "Enabling or Disabling an Inbound Traffic Filter" earlier in this chapter.

To delete an inbound traffic filter from a circuit:

Site Manager Procedure	
You do this	**System responds**
1. Display the Filters window (Figure 6-1). See "Displaying the Inbound Traffic Filters Window."	
2. Select the filter to delete. There is no confirmation of a filter deletion. Make sure you select a filter you want to delete.	
3. Click on **Delete**.	The filter no longer appears in the Filters window.
4. Click on **Apply**.	

Specifying User-Defined Criteria

The Edit Filters window and Edit Template window provide a User-Defined criterion option for most protocols. The User-Defined option allows you to set up a user-defined criterion based on bit patterns in the packet header that are not supported in predefined criteria.

Adding user-defined criteria is similar to adding predefined criteria, except you must specify the criterion's location in the packet. (With predefined criteria, the locations are established.)

See Chapter 3 for the supported protocol header reference points you can use to specify user-defined criteria for inbound traffic filters.

To add a user-defined criterion:

Site Manager Procedure	
You do this	**System responds**
1. Display the Edit Filters window (Figure 6-6) or Edit Template window (Figure 6-4) for the selected circuit and protocol.	
2. Choose Criteria > User-Defined.	The Add User-Defined Field window opens (Figure 6-7).
3. In the REF field, choose the protocol-specific header reference point.	
4. In the OFFSET field, specify a bit offset from the reference point.	
5. In the LENGTH field, specify the length of the criterion.	
6. In the Minimum value and Maximum value fields, specify a range for the criterion.	
7. Click on **OK**.	The Edit Template window or Edit Filters window opens.
8. Continue editing the template or filter. See Table 6-1, "Using the Edit Template Window," or Table 6-2, "Using the Edit Filters Window."	

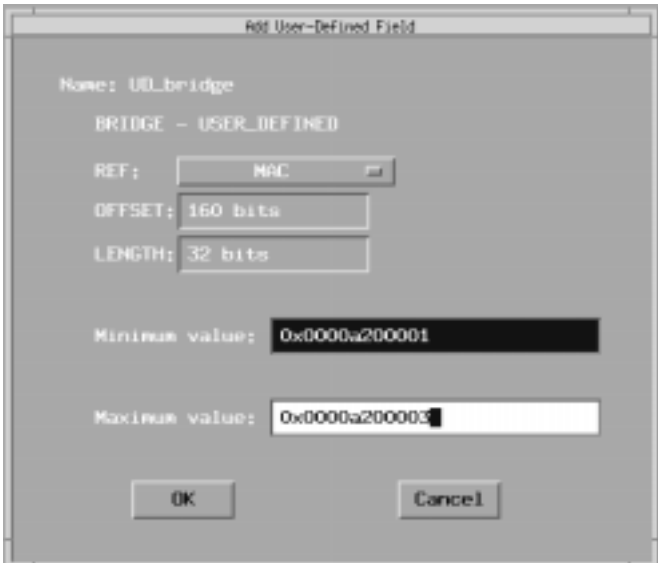

Figure 6-7. Add User-Defined Field Window

Changing Inbound Traffic Filter Precedence

You can assign as many as 31 inbound traffic filters per protocol to each router interface. You can assign as many as 127 inbound traffic filters for IP.

As you add filters to an interface, the Configuration Manager numbers them chronologically (#1, #2, #3, and so on, as shown in Figure 6-8). The number determines the filter precedence; lower filter numbers have higher precedence.

If a packet matches two filters, the filter with the highest precedence (lowest number) applies. For example, if the first filter on the interface (#1) accepts a packet and the second filter (#2) drops the same packet, filter #1 has precedence and the interface accepts the packet.

Figure 6-8 shows how the Filters window displays the filters on an interface. The first filter listed has the highest precedence.

You should create filters on an interface in order of precedence. However, if you do not, or if your filtering strategy changes, you can use the Filters window to rearrange the precedence of existing filters.

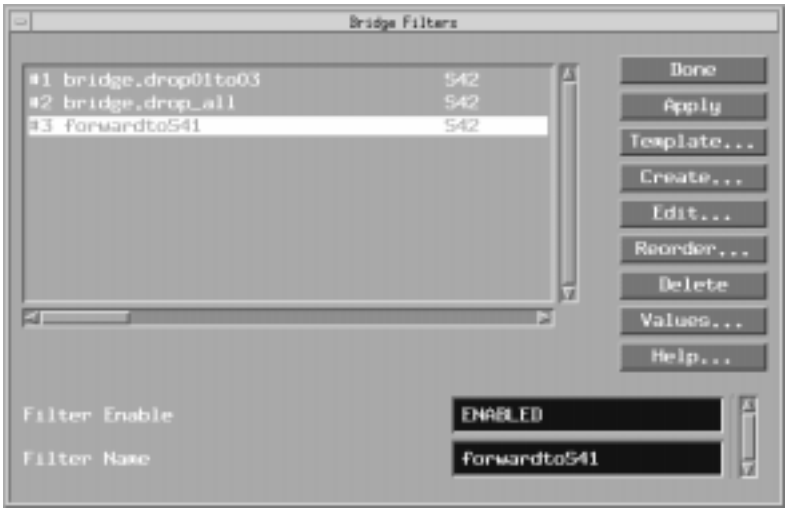

Figure 6-8. Filters Window Showing Filter Precedence

To change the order of precedence for inbound traffic filters:

Site Manager Procedure	
You do this	**System responds**
1. Display the Filters window (Figure 6-1).	
2. Select the filter whose precedence you want to change.	
3. Click on **Reorder**.	The Change Precedence window opens (Figure 6-9).
4. Click on **INSERT BEFORE** or **INSERT AFTER**; then, type a filter rule number in the Precedence Number field. For example, in Figure 6-8, to place the selected filter (#3) *before* filter #1, click on **INSERT BEFORE** and type **1** in the Precedence Number field.	The selected filter's number is either one higher (if you chose INSERT BEFORE) or one lower (if you chose INSERT AFTER) than the number you specified.
5. Click on **OK**.	The Filters window opens. The filters appear in the new order of precedence (Figure 6-10).

Figure 6-9. Change Precedence Window

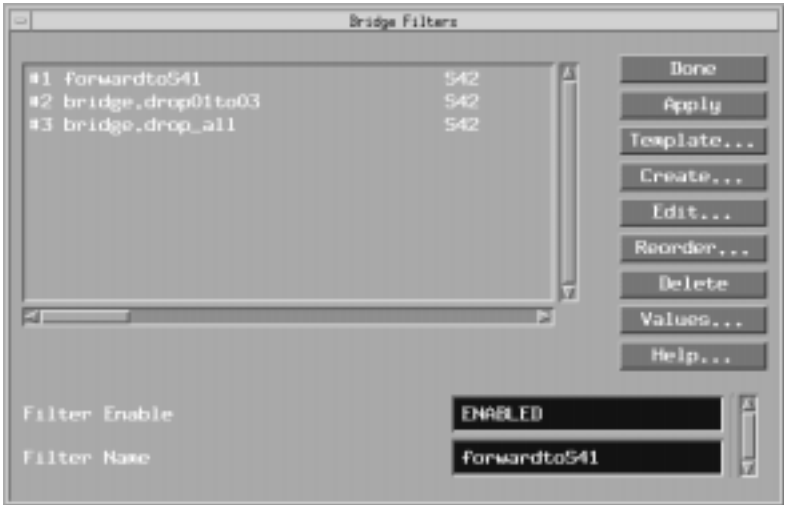

Figure 6-10. Filters Window Showing New Order of Precedence

Chapter 7
Applying Outbound Traffic Filters

This chapter describes how to use the Configuration Manager to configure outbound traffic filters.

Topic	Page
Displaying the Priority/Outbound Filters Window	7-2
Preparing Outbound Traffic Filter Templates	7-4
Creating an Outbound Traffic Filter	7-13
Creating an Outbound Traffic Filter	7-14
Enabling or Disabling an Outbound Traffic Filter	7-18
Deleting an Outbound Traffic Filter	7-19
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To complete the procedures in this chapter, you must be familiar with outbound traffic filter criteria and actions. See Chapter 4 for this information.

You implement protocol prioritization by applying an outbound traffic filter that includes a prioritizing (priority queue) action. This type of outbound traffic filter is called a *priority filter.* For instructions on how to edit protocol prioritization parameters that affect the way priority filters work, see Chapter 2.

Displaying the Priority/Outbound Filters Window

You must complete the following tasks to configure outbound traffic filters on an interface:

- Add the Protocol Priority protocol if it is not already enabled.

  On circuits configured with Frame Relay or PPP, protocol prioritization is enabled by default. Otherwise, you must enable protocol prioritization the first time you configure outbound traffic filters.

- Display the Configuration Manager Priority/Outbound Filters window.

To display the Priority/Outbound Filters window and, if necessary, enable protocol prioritization:

Site Manager Procedure	
You do this	**System responds**
1. Display the Configuration Manager window.	
2. Click on the circuit interface connector (for example, **COM1**, **XCVR2**).	For Ethernet, FDDI, HSSI, synchronous, or token ring interfaces, the Edit Connector window opens. For MCE1 or MCT1 interfaces, the Logical Lines window opens.
3. Click on **Edit Circuit**; or, for MCE1/MCT1, click on **Circuit**.	The Circuit Definition window opens; the circuit you selected is highlighted.
4. If Protocol Priority appears in the Protocols field, go to step 7; otherwise, choose Protocols > Add/Delete.	The Select Protocols window opens.
5. Select Protocol Priority from the list of protocols. The Protocol Priority option is located near the bottom of the list.	
6. Click on **OK**.	The Circuit Definition window opens (Figure 7-1).
7. Choose Protocols > Edit Protocol Priority > Priority/Outbound Filters.	The Priority/Outbound Filters window opens (Figure 7-2).

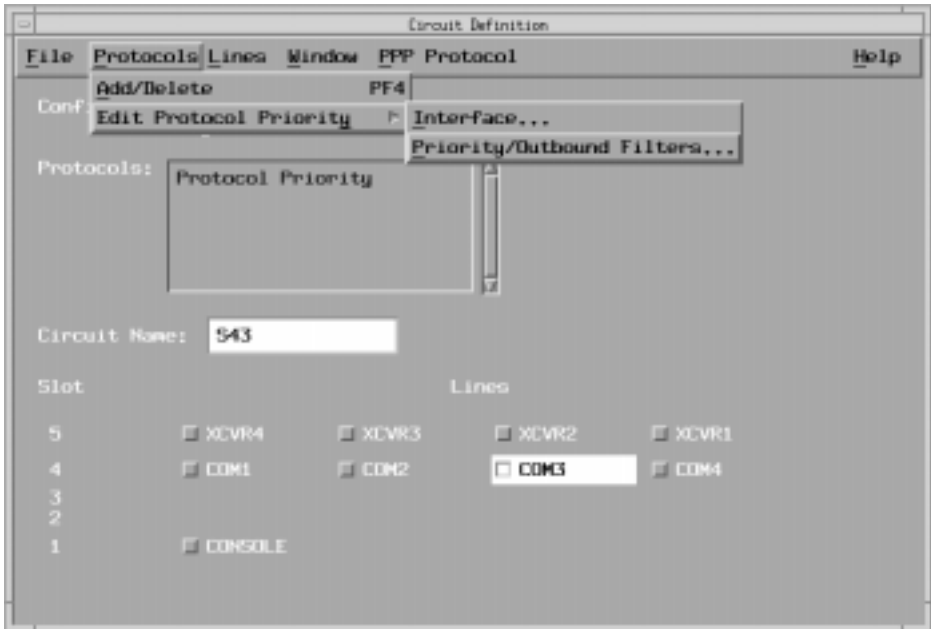

Figure 7-1. Displaying the Priority/Outbound Filters Window

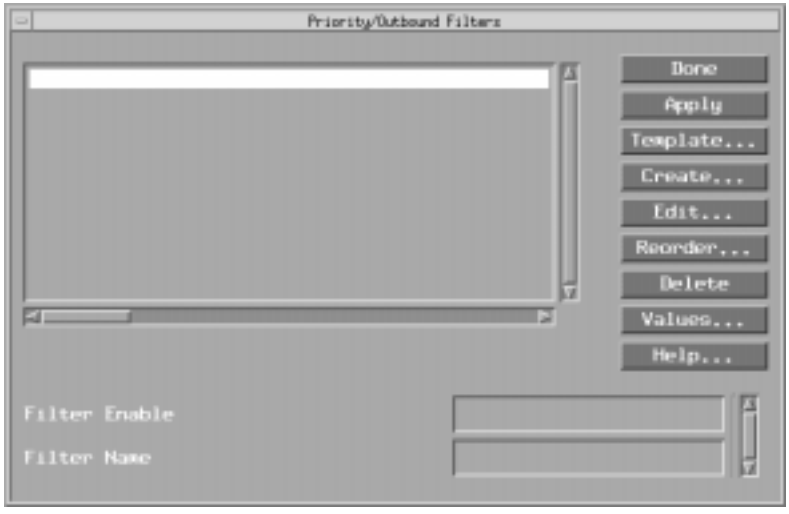

Figure 7-2. Priority/Outbound Filters Window

Preparing Outbound Traffic Filter Templates

To add an outbound traffic filter to an interface, you apply an outbound traffic filter template to the circuit. However, you do not always need to create a template; often, you can begin with an existing template.

This section describes how to prepare an outbound traffic filter template by:

- Creating a Template
- Customizing Templates

See "Creating an Outbound Traffic Filter" later in this chapter to learn how to create a traffic filter by applying (saving) a filter template to an interface.

Note: Changing a traffic filter template does not affect interfaces to which the template has already been applied.

Creating a Template

To create an outbound traffic filter template:

Site Manager Procedure	
You do this	**System responds**
1. Display the Priority/Outbound Filters window (Figure 7-1).	
2. Click on **Template**.	The Filter Template Management window opens (Figure 7-3).
3. Click on **Create**.	The Create Priority/Outbound Template window opens (Figure 7-4).
4. Specify a descriptive name for the template in the Filter Name field. For example, use the name *Bridge01to03* for a template that contains information to filter bridge frames from the MAC source addresses 0x0000A2000001 to 0x0000A2000003.	

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
5. Choose Criteria > Add > Datalink | IP > *criterion*. To configure filters for IP-routed packets, always choose IP instead of Datalink. See Chapter 4 for information about the outbound traffic filter criteria for IP and data link headers.	The Add Range window opens.
6. Specify the range to apply to the selected criterion. To enter a hexadecimal number, use the prefix 0x. Zero is not a valid entry. If the range consists of just one value, specify that value in both fields. See Chapter 5 for information about common traffic filter ranges.	
7. Click on **OK**.	The Create Priority/Outbound Template window opens (Figure 7-4). The new criterion and range appear in the Filter Information field.
8. To add more ranges, choose Range > Add. You can add up to 100 ranges in each template.	
9. Choose Action > Add > Datalink | IP > *action*. For a Datalink criterion, choose a Datalink action; for an IP criterion, choose an IP action.	If you selected the Length action, the Prioritization Length window opens (Figure 7-5). See "Specifying Prioritization Length" for instructions. Otherwise, the Create Priority/Outbound Template window opens, showing the criteria, range, and action in the Filter Information field.
10. Click on **OK**.	The Filter Template Management window opens. The new template appears in the templates list.

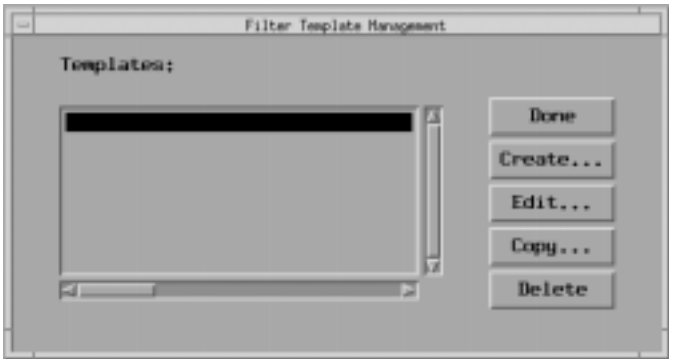

Figure 7-3. Filter Template Management Window

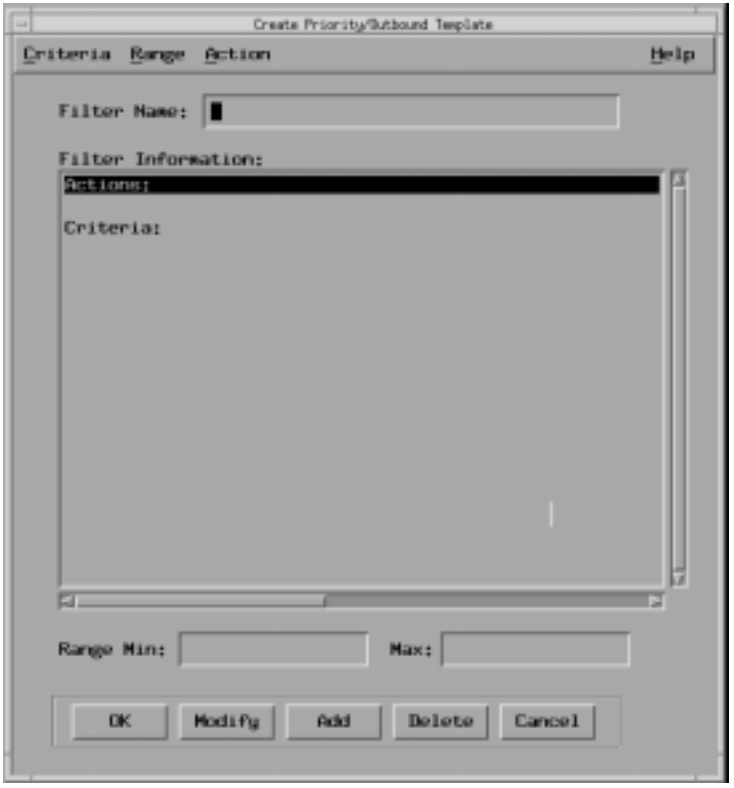

Figure 7-4. Create Priority/Outbound Template Window

Specifying Prioritization Length

When you select the Length action in the Create Priority/Outbound Template window, the Prioritization Length window opens (Figure 7-5).

The Length action directs the router to place each packet in a priority queue, based on the specified byte length of the packet.

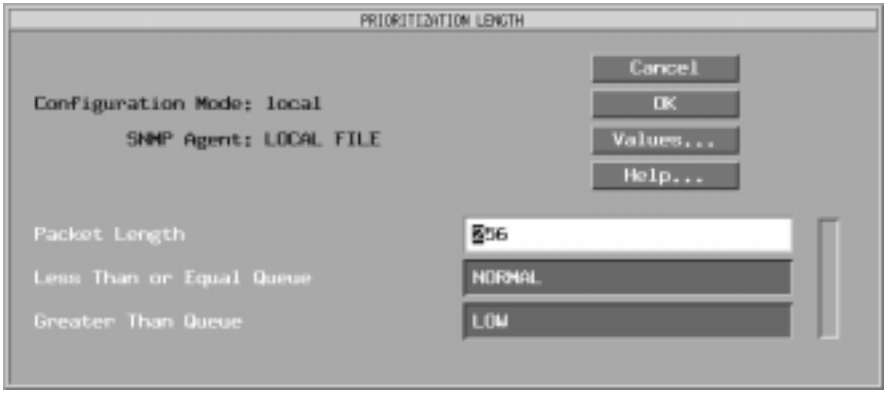

Figure 7-5. Prioritization Length Window

To set the prioritization length parameters:

Site Manager Procedure	
You do this	**System responds**
1. In the Prioritization Length window, specify a byte value between 0 and 4608 in the Packet Length field. Click on **Help** for information, or refer to the description on page A-7 in Appendix A.	
2. Select the Less Than or Equal Queue field; then, click on **Help** for information, or refer to the description on page A-8 in Appendix A.	
3. Click on **Values**.	The Values Selection window opens.

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
4. Select High, Low, or Normal as the queue in which a packet is placed if the length is less than or equal to the value of Packet Length. For example, if Packet Length is set to 1024 bytes, any packet that is 1024 bytes or less is placed in the queue you selected.	
5. Click on **OK**.	The Values Selection window closes. The Prioritization Length window now displays the new value.
6. Select the Greater Than Queue field; then, click on **Help** for information, or refer to the description on page A-8 in Appendix A.	
7. Click on **Values**.	The Values Selection window opens.
8. Select High, Low, or Normal as the queue in which a packet is placed if the length is greater than the value of Packet Length.	
9. Click on **OK**.	The Values Selection window closes. The Prioritization Length window now displays the new value.
10. Click on **OK**.	The Create Priority/Outbound Template window opens, showing the newly selected criterion, range, and action in the Filter Information field (Figure 7-4).
11. Click on **OK**.	The Filter Template Management window opens (Figure 7-3).

Customizing Templates

There are two ways to customize a filter template:

- Copy an existing template, rename it, and then edit it.

  This preserves the original template and creates an entirely new template with the same criteria and actions. You can then modify the new template to suit your needs.

- Edit an existing template.

  If you do not need to preserve the original template, you can edit it without first copying and renaming it. (Changing a template does not affect interfaces to which the template has already been applied.)

Note: You can also edit or copy a template using a text editor. The Configuration Manager stores all templates in the file *template.flt*.

Copying a Template

To duplicate an existing template:

Site Manager Procedure	
You do this	**System responds**
1. Display the Priority/Outbound Filters window (Figure 7-2).	
2. Click on **Template**.	The Filter Template Management window opens (Figure 7-3).
3. Select a template.	
4. Click on **Copy**.	The Copy Filter Template window opens.
5. Specify a name for the new template. Be sure to use a name that reflects its contents.	
6. Click on **OK**.	The Filter Template Management window opens. The new template appears in the templates list.

Editing a Template

After you create or copy a template, edit it as follows:

Site Manager Procedure	
You do this	**System responds**
1. Select a template in the Filter Template Management window.	
2. Click on **Edit**.	The Edit Priority/Outbound Template window opens (Figure 7-6).
3. Add or delete predefined criteria, ranges, and actions (Table 7-1).	
4. Click on **OK**.	The Filter Template Management window opens.
5. Click on **Done**.	The Priority/Outbound Filters window opens (Figure 7-2).

Table 7-1 describes how to add, delete, or modify predefined criteria, ranges, and actions in the Edit Priority/Outbound Template window (Figure 7-6).

To add a user-defined criterion, see "Specifying User-Defined Criteria" later in this chapter. To add the Length action, see "Specifying Prioritization Length" earlier in this chapter.

Figure 7-6. Edit Priority/Outbound Template Window

Table 7-1. Using the Edit Priority/Outbound Template Window

Task	Site Manager Procedure	Notes
Add a criterion	1. Choose Criteria > Add > *criterion*. The Add Range window opens.	A template can have only one criterion. You must specify at least one range in a template.
	2. Type a range in the Minimum value and Maximum value fields, then click on **OK**.	
Delete a criterion	1. Select the criterion to delete in the Filter Information field.	A template must have a criterion. Specify a new criterion after deleting one.
	2. Click on **Delete**. The Delete Criteria window opens.	
	3. Click on **Delete**.	
Add a range	1. Select the criterion in the Filter Information field.	You can add up to 100 ranges. If the range consists of a single value, type the value in the Minimum value field only. Use the prefix 0x to specify a hexadecimal number. Zero is not a valid entry.
	2. Click on **Add**. The Add Range window opens.	
	3. Type a range in the Minimum value and Maximum value fields, then click on **OK**.	
Modify a range	1. Select the range to modify in the Filter Information field.	Ranges are listed below the criterion in the Filter Information field. Selected ranges appear in the Range Min and Range Max fields at the bottom of the Edit Priority/ Outbound Template window.
	2. Click on **Modify**.	
	3. Type new values in the Range Min and Range Max fields.	
Delete a range	1. Select the range to delete in the Filter Information field.	You must specify at least one range for each criterion.
	2. Click on **Delete**. The Delete Range window opens.	
	3. Click on **Delete**.	
Add an action	1. Choose Action > Add > *action*.	With the exception of the Log action, each template has only one action.
Delete an action	1. Select an action in the Filter Information field.	You must specify at least one action in a template.
	2. Click on **Delete**. The Delete Action window opens.	
	3. Click on **Delete**.	
Save the template	1. Click on **OK**. The Filter Template Management window opens.	Be sure you have specified: • Only one criterion • Only one action • 1-100 ranges

Creating an Outbound Traffic Filter

You create an outbound traffic filter by applying a filter template to an interface.

Note: You should create the filters on an interface in order of precedence. The first filter you create has the highest precedence and a rule number of 1. Subsequent filters that you create have lower precedence. For more information, see "Changing Outbound Traffic Filter Precedence" later in this chapter.

To create an outbound traffic filter:

Site Manager Procedure	
You do this	**System responds**
1. Display the Priority/Outbound Filters window (Figure 7-2).	
2. Click on **Create**.	The Create Filter window opens (Figure 7-7).
3. Select a circuit in the Interfaces field.	
4. Select a template in the Templates field. If the Templates field is empty, complete the steps in "Preparing Outbound Traffic Filter Templates."	
5. In the Filter Name field, specify a name for the new filter. It can be helpful to include the circuit name to differentiate the template from the filter. For example, specify *Drop_Telnet_S42* as the name of a filter that drops outbound Telnet traffic on the synchronous circuit S42. For priority filters, include the queue name. For example, specify *SRB_DSAP_hiQ* as the name of a filter that places SRB traffic of a certain DSAP range in the High queue.	
6. Click on **OK**.	The Priority/Outbound Filters window opens.

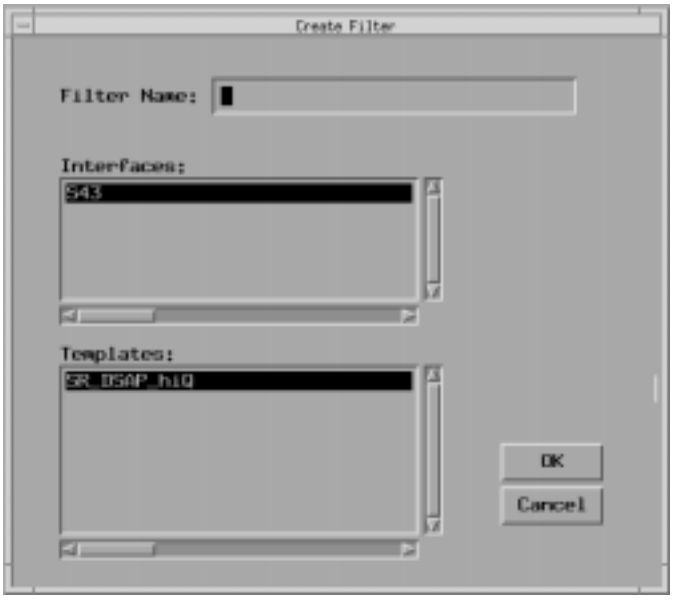

Figure 7-7. Create Filter Window

Editing an Outbound Traffic Filter

After you apply an outbound traffic filter to an interface, you can edit its criterion, ranges, or action. If you used a template that you edited to suit your needs, you may not need to make further edits.

When you customize a filter, you have the following options:

- Add or delete predefined criteria
- Add or delete user-defined criteria
- Add or delete actions
- Add, modify, or delete ranges

To add a user-defined criterion, see "Specifying User-Defined Criteria" later in this chapter. To add the Length action, see "Specifying Prioritization Length" earlier in this chapter.

To add predefined criteria, ranges, and actions, or delete any criterion, range, or action:

Site Manager Procedure	
You do this	**System responds**
1. Display the Priority/Outbound Filters window (Figure 7-2).	
2. Select a filter.	
3. Click on **Edit**.	The Edit Priority/Outbound Filters window opens (Figure 7-8).
4. Add, change, or delete predefined criteria, ranges, and actions (Table 7-2).	
5. Click on **OK**.	The Priority/Outbound Filters window opens.

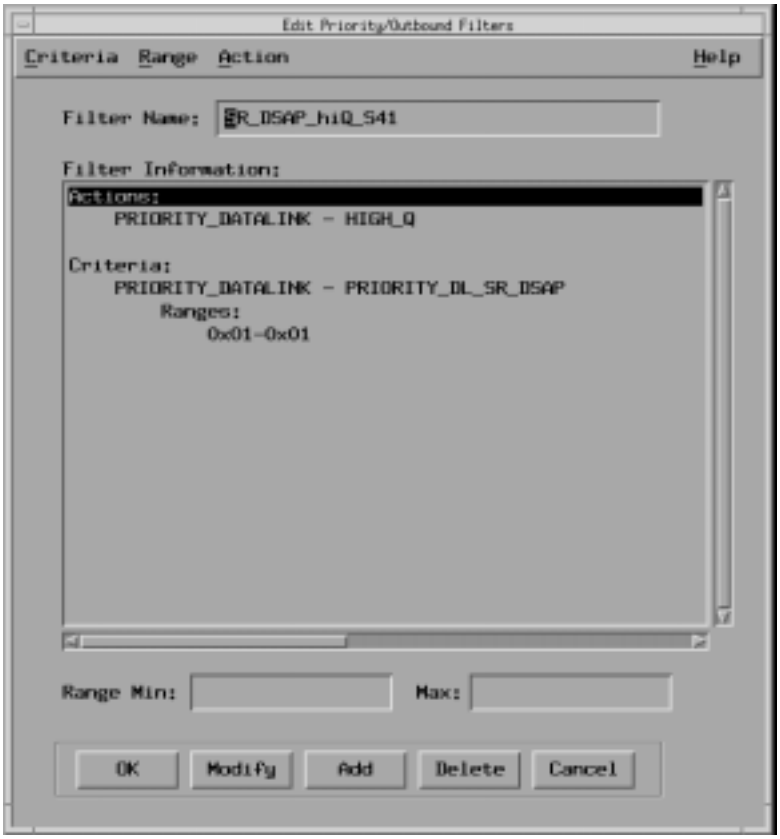

Figure 7-8. Edit Priority/Outbound Filters Window

Table 7-2. Using the Edit Priority/Outbound Filters Window

Task	Site Manager Procedure	Notes
Add a criterion	1. Choose Criteria > Add > *criterion*. The Add Range window opens. 2. Type a range in the Minimum value and Maximum value fields, then click on **OK**.	A filter can have only one criterion. You must specify at least one range for the filter.
Delete a criterion	1. Select the criterion to delete in the Filter Information field. 2. Click on **Delete**. The Delete Criteria window opens. 3. Click on **Delete**.	A filter must have a criterion. Specify a new criterion after deleting one.
Add a range	1. Select the criterion in the Filter Information field. 2. Click on **Add**. The Add Range window opens. 3. Type a range in the Minimum value and Maximum value fields, then click on **OK**.	You can add up to 100 ranges. If the range consists of a single value, type the value in the Minimum value field only. Use the prefix 0x to specify a hexadecimal number. Zero is not a valid entry.
Modify a range	1. Select the range to modify in the Filter Information field. 2. Click on **Modify**. 3. Type new values in the Range Min and Range Max fields.	Ranges are listed below the criterion in the Filter Information field. Selected ranges appear in the Range Min and Max fields at the bottom of the Edit Priority/Outbound Filters window.
Delete a range	1. Select the range to delete in the Filter Information field. 2. Click on **Delete**. The Delete Range window opens. 3. Click on **Delete**.	You must specify at least one range for each criterion.
Add an action	1. Choose Action > Add > *action*.	With the exception of the Log action, each filter has only one action.
Delete an action	1. Select an action in the Filter Information field. 2. Click on **Delete**. The Delete Action window opens. 3. Click on **Delete**.	You must specify at least one action in a filter.
Apply the changes	1. Click on **OK**. The Priority/Outbound Filters window opens. 2. Click on **Apply**.	Be sure you have specified: • Only one criterion • Only one action • 1-100 ranges

Enabling or Disabling an Outbound Traffic Filter

There may be times when you want to turn off a filter temporarily. Instead of deleting a filter from a circuit, you can disable the filter and then reenable it later.

To disable or reenable an outbound traffic filter:

Site Manager Procedure	
You do this	**System responds**
1. Display the Priority/Outbound Filters window (Figure 7-2).	
2. Select the filter to disable or enable.	The Filter Enable and Filter Name fields show the current status of the selected filter.
3. Click on **Values**.	The Values Selection window opens.
4. To disable the filter, select Disabled. To enable the filter, select Enabled.	
5. Click on **OK**.	The Values Selection window closes. The Filter Enable field in the Priority/ Outbound Filters window indicates the change.
6. Click on **Apply**.	The filter's action is now disabled or enabled.

Deleting an Outbound Traffic Filter

Deleting an outbound traffic filter permanently removes the filter from the circuit, but does not affect the template used to create the filter.

Note: Instead of deleting a filter, you may want to turn off the filter temporarily. You can do this by disabling the filter on a circuit. See "Enabling or Disabling an Outbound Traffic Filter" earlier in this chapter.

To delete an outbound traffic filter from a circuit:

Site Manager Procedure	
You do this	**System responds**
1. Display the Priority/Outbound Filters window (Figure 7-2).	
2. Select the filter to delete. There is no confirmation of a filter deletion. Make sure you select a filter you want to delete.	
3. Click on **Delete**.	The filter no longer appears in the Priority/Outbound Filters window.
4. Click on **Apply**.	

Specifying User-Defined Criteria

The Edit Priority/Outbound Filters window and Edit Priority/Outbound Template window provide a User-Defined criterion option.The User-Defined option allows you to set up a user-defined criterion based on bit patterns in the packet's data link or IP header that are not supported in predefined criteria.

Adding user-defined criteria is similar to adding predefined criteria, except you must specify the criterion's location in the packet. (With predefined criteria, the locations are established.)

See Chapter 4 for the supported IP and data link header reference points you can use to specify user-defined criteria for outbound traffic filters.

To add a user-defined criterion:

Site Manager Procedure	
You do this	**System responds**
1. Display the Edit Priority/Outbound Template window (Figure 7-6) or Edit Priority/Outbound Filters window (Figure 7-8).	
2. Choose Criteria > User-Defined.	The Add User-Defined Field window opens (Figure 7-9).
3. In the REF field, choose the header reference point.	
4. In the OFFSET field, specify a bit offset from the reference point.	
5. In the LENGTH field, specify the length of the criterion.	
6. In the Minimum value and Maximum value fields, specify a range for the criterion.	
7. Click on **OK**.	The Edit Priority/Outbound Template window or Edit Priority/Outbound Filters window opens.
8. Continue editing the template or filter. See Table 7-1, "Using the Edit Priority/ Outbound Template Window," or Table 7-2, "Using the Edit Priority/Outbound Filters Window."	

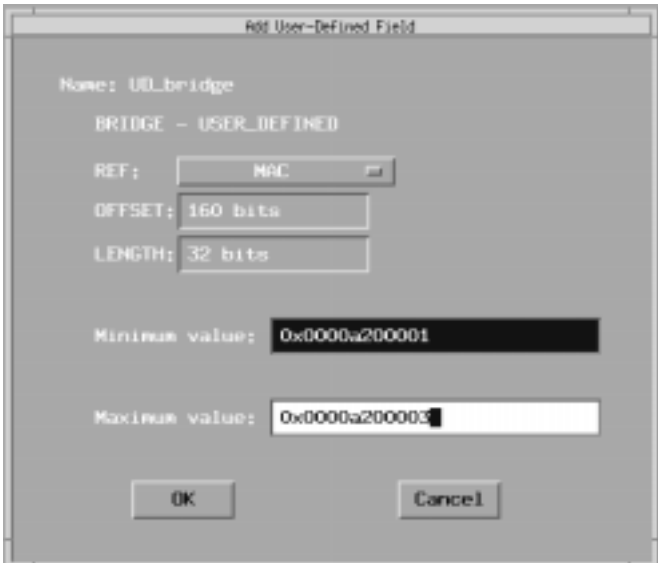

Figure 7-9. Add User-Defined Field Window

Changing Outbound Traffic Filter Precedence

You can assign as many as 31 outbound traffic filters based on data link criteria to each interface.

As you add filters to an interface, the Configuration Manager numbers them chronologically (#1, #2 and so on) and adds an IP or data link (DL) prefix, as shown in Figure 7-10. The number determines the filter precedence; lower filter numbers have higher precedence.

If a packet matches two filters, the filter with the highest precedence (lowest number) applies. For example, if the first filter on the interface (#1) accepts a packet and the second filter (#2) drops the same packet, filter #1 has precedence and the interface accepts the packet.

Figure 7-10 shows how the Priority/Outbound Filters window displays the filters on an interface. The first filter listed has the highest precedence.

You should create the filters on an interface in order of precedence. However, if you do not, or if your filtering strategy changes, you can use the Priority/ Outbound Filters window to rearrange the precedence of existing filters.

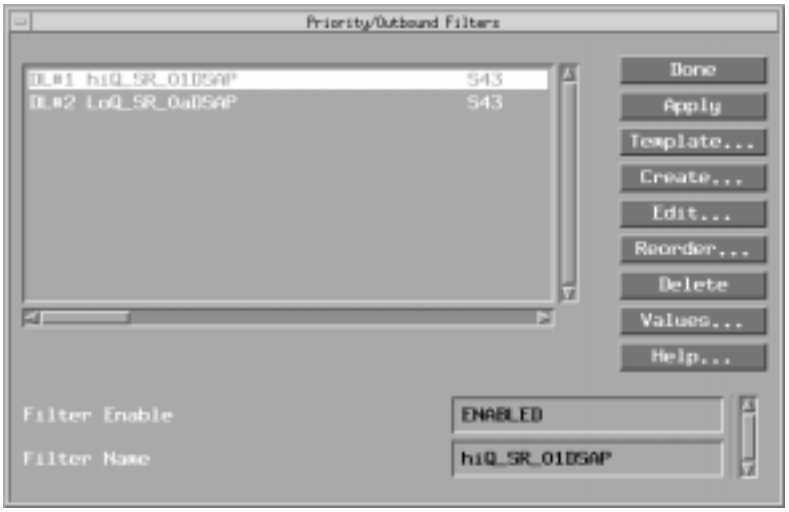

Figure 7-10. Priority/Outbound Filters Window Showing Filter Precedence

To change the order of precedence for outbound traffic filters:

Site Manager Procedure	
You do this	**System responds**
1. Display the Priority/Outbound Filters window (Figure 7-2).	
2. Select the filter whose precedence you want to change.	
3. Click on **Reorder**.	The Change Precedence window opens (Figure 7-11).
4. Click on **INSERT BEFORE** or **INSERT AFTER**.	
5. Type a filter rule number in the Precedence Number field. For example, in Figure 7-10, to place the selected filter (#1) *after* filter #2, click on **INSERT BEFORE** and type **2** in the Precedence Number field.	The selected filter's number is either one higher (if you chose INSERT BEFORE) or one lower (if you chose INSERT AFTER) than the number you specified.
6. Click on **OK**.	The Priority/Outbound Filters window opens. The filters now appear in the new order of precedence (Figure 7-12).

Figure 7-11. Change Precedence Window

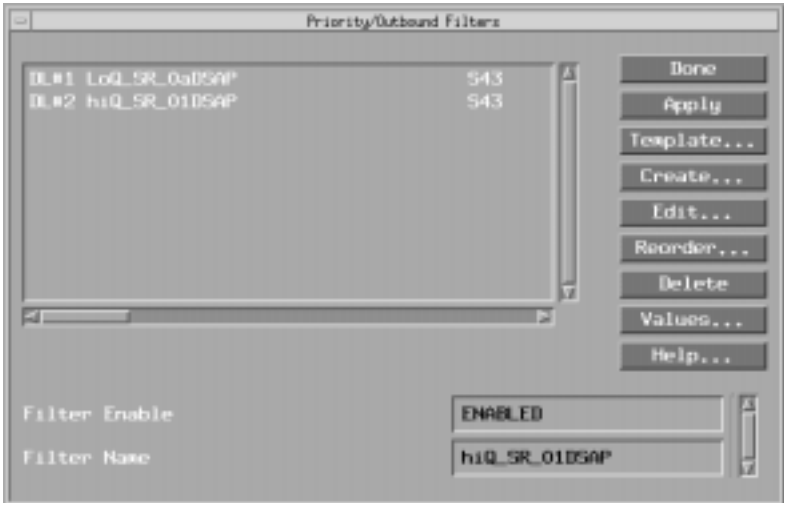

Figure 7-12. Priority/Outbound Filters Window Showing New Order of Precedence

Appendix A
Site Manager Protocol Prioritization Parameters

This appendix contains reference information for the Site Manager protocol prioritization parameters.

Topic	Page
Priority Interface Parameter Descriptions	A-2
Prioritization Length Parameters	A-7

For each parameter, this appendix provides the following information:

- Parameter name
- Configuration Manager menu path
- Default setting
- Valid parameter options
- Parameter function
- Instructions for setting the parameter
- MIB object ID

Priority Interface Parameter Descriptions

Use the following descriptions as guidelines when you edit parameters in the Edit Protocol Priority Interface window.

Parameter: Enable

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Interface

Default: Enable

Options: Enable | Disable

Function: Toggles protocol prioritization on and off on this interface. If you set this parameter to Disable, all outbound traffic filters will be disabled on this interface. Setting this parameter to Disable is useful if you want to temporarily disable all outbound traffic filters rather than delete them.

Instructions: Set to Disable if you want to temporarily disable all protocol prioritization activity on this interface. Set to Enable if you previously disabled protocol prioritization on this interface and now want to reenable it.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.1.1.2

Parameter: High Queue Size

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Interface

Default: 20

Options: Any integer value

Function: Specifies the maximum number of packets in the High queue at any one time, regardless of packet size.

Instructions: Accept the default or specify a new value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.1.1.4

Parameter: **Normal Queue Size**

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Interface

Default: 20 (200 for Frame Relay)

Options: Any integer value

Function: Specifies the maximum number of packets in the Normal queue at any one time, regardless of packet size.

Instructions: Accept the default or specify a new value.

For Frame Relay interfaces, a value less than 200 might cause a broadcast message to be dropped (clipped).

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.1.1.5

Parameter: **Low Queue Size**

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Interface

Default: 20

Options: Any integer value

Function: Specifies the maximum number of packets in the Low queue at any one time, regardless of packet size.

Instructions: Accept the default or specify a new value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.1.1.6

Parameter: **Max High Queue Latency**

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Interface

Default: 250 milliseconds (ms)

Options: 100 to 5000 ms

Function: Specifies the greatest delay that a high-priority packet can experience and, consequently, how many normal-priority or low-priority bits can be in the transmit queue at any one time.

Instructions: Accept the default or specify a new value. Bay Networks recommends accepting the default value of 250 ms.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.1.1.8

Parameter: High Water Packets Clear

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Interface

Default: 0

Options: Any integer value

Function: Toggles the High Water Packets Clear bit. When you change the queue depth (by changing the value of the High Queue Size, Normal Queue Size, or Low Queue Size parameter), you can also reset the high-water mark by changing the value of this parameter. When you change the value of this parameter, you reset the high-water mark for all three queues to zero.

Instructions: Specify a new integer value for this parameter to clear the existing high-water marks for the priority queues.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.1.1.19

Parameter: Prioritization Algorithm Type

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Interface

Default: BANDWIDTH ALLOCATION

Options: BANDWIDTH ALLOCATION | STRICT

Function: Selects the dequeuing algorithm that protocol prioritization uses to drain priority queues and transmit traffic. With strict dequeuing, the router always transmits traffic in the High queue before transmitting traffic in the other queues. With bandwidth allocation dequeuing, the router transmits traffic in a queue until the utilization percentage for that queue is reached; then, the router transmits traffic in the next-lower-priority queue. (You configure the percentages for bandwidth allocation by setting the High Queue, Normal Queue, and Low Queue Percent Bandwidth parameters.)

Instructions: Accept the default of BANDWIDTH ALLOCATION or select STRICT.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.1.1.24

Parameter: High Queue Percent Bandwidth

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Interface

Default: 70 percent

Options: 0 to 100 percent

Function: If you select the bandwidth allocation dequeuing algorithm, this parameter specifies the percentage of the synchronous line's bandwidth allocated to traffic that has been sent to the High queue. When you set this parameter to a value less than 100, each time the percentage of bandwidth used by high-priority traffic reaches this limit, the router transmits traffic in the Normal and Low queues, up to the configured percentages for those priority queues.

Instructions: Specify the percentage of the line's bandwidth allocated to high-priority traffic. The High Queue, Normal Queue, and Low Queue Percent Bandwidth values must total 100.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.1.1.25

Parameter: Normal Queue Percent Bandwidth

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Interface

Default: 20 percent

Options: 0 to 100 percent

Function: If you select the bandwidth allocation dequeuing algorithm, this parameter specifies the percentage of the synchronous line's bandwidth allocated to normal-priority traffic.

Instructions: Specify the percentage of the line's bandwidth allocated to normal-priority traffic. The High Queue, Normal Queue, and Low Queue values must total 100.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.1.1.26

Parameter: Low Queue Percent Bandwidth

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Interface

Default: 10 percent

Options: 0 to 100 percent

Function: If you select the bandwidth allocation dequeuing algorithm, this parameter specifies the percentage of the synchronous line's bandwidth allocated to low-priority traffic.

Instructions: Specify the percentage of the line's bandwidth allocated to low-priority traffic. The High Queue, Normal Queue, and Low Queue Percent Bandwidth values must total 100.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.1.1.26

Parameter: Discard Eligible Bit Low

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Interface

Default: ENABLE

Options: ENABLE | DISABLE

Function: Sets the Frame Relay discard eligible (DE) bit for packets sent to the Low queue.

Instructions: Select DISABLE if you do not want to set the DE bit for all Frame Relay packets in the Low queue.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.1.1.37

Parameter: Discard Eligible Bit Normal

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Interface

Default: DISABLE

Options: ENABLE | DISABLE

Function: Sets the Frame Relay discard eligible (DE) bit for packets sent to the Normal queue.

By default, Frame Relay packets in the Normal queue do not have the DE bit set.

Instructions: Select ENABLE if you want to set the DE bit for all Frame Relay packets in the Normal queue.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.1.1.38

Prioritization Length Parameters

Use the following descriptions as guidelines when you edit parameters in the Prioritization Length window.

Parameter: Packet Length

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Priority/Outbound Filters > **Create** > Create Priority/Outbound Template > Actions > Length > Prioritization Length

Default: None

Options: 0 to 4608 bytes

Function: Defines a packet-length measurement by which each packet that passes the filter criterion is compared. The action that is applied to each packet depends on whether it is less than, equal to, or greater than the value you specify. This action also depends on the values of the Less Than or Equal Queue parameter and the Greater Than Queue parameter.

Instructions: Specify a packet-length value, in bytes.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.4.1.7

Parameter: Less Than or Equal Queue

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Priority/Outbound Filters > **Create** > Create Priority/ Outbound Template > Actions > Length > Prioritization Length

Default: NORMAL

Options: HIGH | LOW | NORMAL

Function: Specifies the queue in which a packet is placed if its length is less than or equal to the value of the Packet Length parameter. For example, if Packet Length is set to 1024 bytes, any packet that is 1024 bytes or less is placed in the queue you specify.

Instructions: Accept the default, NORMAL, or select LOW or HIGH.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.4.1.8

Parameter: Greater Than Queue

Path: Configuration Manager > *interface connector* > **Edit Circuit** > Protocols > Edit Protocol Priority > Priority/Outbound Filters > **Create** > Create Priority/ Outbound Template > Actions > Length > Prioritization Length

Default: LOW

Options: HIGH | LOW | NORMAL

Function: Specifies the queue in which a packet is placed if its length is greater than the value of the Packet Length parameter. For example, if Packet Length is set to 1024 bytes, any packet that is 1025 bytes or larger is placed in the queue you specify for this parameter.

Instructions: Accept the default, LOW, or select NORMAL or HIGH.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.4.4.1.9

Appendix B
Examples and Implementation Notes

This appendix contains examples, hints, reminders, and important notes you may find useful.

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Traffic Filter Example for Basic IP Network Security	B-1
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Traffic Filter Example for Basic IP Network Security

In a network configuration with a single leased or dial-up connection to the Internet, one common use for traffic filters is to restrict external access to the network without restricting outbound service for users.

This section provides a step-by-step example for creating an inbound IP traffic filter to prevent access to a network through the well-known TCP and UDP ports. The procedure assumes that you are working at a station that is running Site Manager.

To further restrict access, you can create additional inbound IP traffic filters to limit services to specific IP source and destination addresses. "Inbound Traffic Filter Examples," later in this appendix, provides an example of allowing only a specified subset of Telnet, TFTP, and FTP users.

To create an inbound IP traffic filter that prevents access to a network through TCP and UDP ports:

Site Manager Procedure	
You do this	**System responds**
1. In the Site Manager main window, choose Tools > Configuration Manager > Remote | Dynamic | Local > *config file*	The Configuration Manager window opens.
2. Click on the connector for the configured IP circuit (for example, **COM2**).	The Edit Connector window opens.
3. Click on **Edit Circuit**.	The Circuit Definition window opens; the circuit you selected is highlighted.
4. Choose Protocols > Edit IP > Traffic Filters.	The IP Filters window opens.
5. Click on **Template**.	The Filter Template Management window opens.
6. Click on **Create**.	The Create IP Filter Template window opens.
7. Specify a descriptive name in the Filter Name field (for example, *accepted*).	
8. Choose Criteria > Add > TCP or UDP Frame > TCP or UDP Source Port.	The Add Range window opens.
9. Type **0** in the Minimum value field and **9999** in the Maximum value field, then click on **OK.**	The Add Range window closes. The criterion and range now appear in the Filter Information field of the Create IP Filter Template window.
10. Choose Action > Add > Accept.	The action now appears in the Filter Information field.
11. Click on **OK**.	The Filter Template Management window opens. The new template appears in the templates list.
12. Click on **Done**.	The IP Filters window opens.
13. Click on **Create**.	The Create Filters window opens.
14. Select a template in the Templates field.	
15. Select a circuit in the Interfaces field.	

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
16. Specify a descriptive name in the Filter Name field. Use a name that indicates the circuit (for example, *S41_accepted*).	
17. Click on **OK**.	The IP Filters window opens.
18. Click on **Apply**.	The filter is applied to the circuit.

Inbound Traffic Filter Examples

This section summarizes the steps for creating an inbound traffic filter and provides examples (Table B-1 and Table B-2) for using inbound traffic filters to accomplish common filtering goals.

If Tables B-1 and B-2 do not include an example for the protocol you want to configure, use these examples as guidelines for implementing inbound traffic filters for other traffic types. Chapter 3 lists the inbound traffic filter criteria and actions for all supported protocols.

To create an inbound traffic filter:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose Circuits > Edit Circuits.	The Circuit List window opens.
2. Select a circuit.	
3. Click on **Edit**.	The Circuit Definition window opens; the circuit you selected is highlighted.
4. Choose Protocols > Edit *protocol* > Traffic Filters. The menu path to the Filters window is protocol specific.	The Filters window for the selected protocol opens. It lists any inbound traffic filters already applied to the circuit.
5. Click on **Template**.	The Filter Template Management window opens. It lists any inbound traffic filter templates already configured for the selected protocol.

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
6. Click on **Create**.	The Create Filter Template window for the selected protocol opens.
7. Specify a descriptive name in the Filter Name field.	
8. Choose Criteria > Add > *criterion*. See Table B-1 or Table B-2 for specific examples.	The Add Range window opens. (If you selected the User-Defined criterion, the Add User-Defined Field window opens first.)
9. Type a minimum and maximum value to specify the range, then click on **OK**. See Table B-1 or Table B-2 for specific examples. To specify additional ranges, choose Range > Add.	The Add Range window closes. The new criterion and ranges now appear in the Filter Information field of the Create Filter Template window.
10. Choose Action > Add > *action*. See Table B-1 or Table B-2 for specific examples.	The action appears in the Filter Information field.
11. Click on **OK**.	The Filter Template Management window opens. The new template appears in the templates list.
12. Click on **Done**.	The Filters window opens.
13. Click on **Create**.	The Create Filter window opens.
14. Specify a descriptive name in the Filter Name field.	
15. Select a template in the Templates field.	
16. Select a circuit in the Interfaces field.	
17. Click on **OK**.	The Filters window opens.
18. Click on **Apply**.	The filter is applied to the circuit.

Chapter 6 provides detailed procedures for creating inbound traffic filters and traffic filter templates.

Table B-1 lists sample predefined criteria, ranges, and actions for some common filtering goals.

Table B-1. Predefined Criteria, Ranges, and Actions for Sample Inbound Traffic Filters

Filtering Goal	Criteria Path	Ranges	Action Path	Notes
Configure a subset of allowed Telnet, TFTP, and FTP users	Criteria > Add > IP Source Address	Client IP source addresses Use dotted-decimal format.	Action > Add > Accept	This strategy works only if the destination IP address is one of the router's interfaces and if the protocol or well-known port is Telnet, TFTP, or FTP.
Configure a router to drop BootP requests from particular clients	Criteria > Add > UDP Frame > UDP Destination Port	MAC addresses of the BootP clients	Action > Add > Drop	
Drop inbound Telnet traffic	Criteria > Add > IP > TCP Frame > TCP Destination Port	23 See Table 5-6 in Chapter 5 for a list of common TCP port ranges.	Action > Add > Drop	For a more secure method, create a user-defined filter (see Table B-2). This filter will not stop remote users from establishing a Telnet session with the router. To do that, you must also create outbound traffic filters on the remote circuits.

Table B-2 lists sample user-defined criteria, ranges, and actions for some common filtering goals.

Table B-2. User-Defined Criteria and Ranges for Sample Inbound Traffic Filters

Filtering Goal	User-Defined Criteria			Range
	Reference Field	Offset	Length	
Drop inbound Telnet and FTP traffic on the synchronous interface that receives packets from the Internet	IP HEADER_END	107 109	1	0x0 to 0x0
Give certain VINES traffic that is bridged over Ethernet precedence over all other traffic	Specify an Ethernet Type value of 0xBAD (VINES)	160 bits (sum of all criteria that precede the Destination Network field, or 48+48+16+16+16+8+8)	32 bits	Specify the hexadecimal Destination Network number (for example, 1234).
On a DLSw circuit, filter on NetBIOS Names	DLS_DATA_START	376 (Destination NetBIOS Names) 504 (Source NetBIOS Names) The offset of 376 applies only if you want to filter the beginning of the NetBIOS Name field. If you want to find a particular section of the NetBIOS Name, increase the offset by X * 8, where X is the number of bytes into the NetBIOS Name field.	NetBIOS Names are up to 16 bytes long. How they are oriented in the field (right justified or left justified) may depend on the application. Before creating the filter criteria, use an analyzer to check the packets.	Specify NetBIOS Name ranges, using the ASCII equivalent of the first 15 characters in the name. For names with less than 15 characters, use 0x20 as pad characters.

Protocol Prioritization Examples

This section summarizes the steps and provides examples (Table B-3) for configuring protocol priority queues. If Table B-3 does not include an example for the filter you want to configure, use these examples as guidelines.

Chapter 7 provides detailed procedures for configuring outbound traffic filters. Chapter 4 lists the outbound traffic filter criteria and actions. Chapter 2 describes protocol prioritization and provides procedures for setting configuration parameters.

Creating an Outbound Traffic Filter

To create an outbound traffic filter:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose Circuits > Edit Circuits.	The Circuit List window opens.
2. Select a circuit.	
3. Click on **Edit**.	The Circuit Definition window opens; the circuit you selected is highlighted.
4. Choose Protocols > Edit Protocol Priority > Priority/Outbound Filters.	The Priority/Outbound Filters window opens.
5. Click on **Template**.	The Filter Template Management window opens.
6. Click on **Create**.	The Create Priority/Outbound Template window opens.
7. Specify a descriptive name in the Filter Name field.	
8. Choose Criteria > Add > Datalink | IP > *criterion*. See Table B-3 for specific examples.	The Add Range window opens. (If you chose the User-Defined criterion, the Add User-Defined Field window opens first.)

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
9. Type a minimum and maximum value to specify the range, then click on **OK**. See Table B-3 for specific examples. To specify additional ranges, choose Range > Add.	The Add Range window closes. The new criterion and ranges now appear in the Filter Information field of the Create Priority/Outbound Template window.
10. Choose Action > Add > *action*. See Table B-3 for specific examples.	
11. Click on **OK**.	The Filter Template Management window opens. The new template appears in the templates list.
12. Click on **Done**.	The Priority/Outbound Filters window opens.
13. Click on **Create**.	The Create Filter window opens.
14. Select a circuit in the Interfaces field.	
15. Select a template in the Templates field.	
16. Specify a descriptive name in the Filter Name field.	
17. Click on **OK**.	The Priority/Outbound Filters window opens.
18. Click on **Apply**.	The filter is applied to the circuit.

Table B-3 provides some examples of using outbound traffic filters for protocol prioritization goals.

Table B-3. Sample Criteria, Ranges, and Actions for Protocol Prioritization

Filtering Goal	Criteria Path	Ranges	Action Path	Notes
Place LAT traffic in the High queue (since LAT is a time-sensitive protocol)	Criteria > Add > Datalink > Datalink Type > Ethernet type Note: If this is a Frame Relay interface, specify SNAP instead of Ethernet Type.	6004	Action > Datalink > Add > High Queue	See Table 5-8 in Chapter 5 for a list of common Ethernet Type codes.
Place ICMP traffic in the Low queue (ICMP is not a time-sensitive protocol)	Criteria > Add > IP > IP > Protocol	1	Action > IP > Add > Low Queue	See Table 5-9 in Chapter 5 for a list of common IP Protocol and Type codes.
Place SNA traffic in the High queue	Criteria > Add > Datalink > Source Routing > DSAP Note: To prioritize IP-encapsulated SNA traffic, choose Criteria > Add > IP > Source Routing > DSAP.	DSAP values: 0x04 to 0x05 0x08 to 0x09 0x0c to 0x0d See Chapter 5 for information on specifying MAC address or SAP criteria ranges.	Action > Datalink > Add > High Queue Note: To prioritize IP-encapsulated SNA traffic, choose Action > IP > Add > High Queue.	You can also choose SSAP, Destination MAC Address, or Source MAC Address as the criteria.
Place all DLSw traffic leaving a particular synchronous interface in the High queue	Criteria > Add > IP > IP > TCP Destination Port	2065 to 2067 See Table 5-6 in Chapter 5 for a list of common TCP port ranges.	Action > IP > Add > High Queue	This example shows how to give DLSw traffic priority over other protocols on the interface. To modify the priority of specific types of DLSw traffic at the TCP level, use DLSw protocol prioritization, as described in *Configuring DLSw Services*.

(continued)

Table B-3. Sample Criteria, Ranges, and Actions for Protocol Prioritization *(continued)*

Filtering Goal	Criteria Path	Ranges	Action Path	Notes
Place RIP traffic in the Low queue	Criteria > Add > IP > IP > UDP Destination Port	520	Action > IP > Add > Low Queue	See Table 5-7 in Chapter 5 for a list of common UDP port codes.
Place OSPF traffic in the High queue	Criteria > Add > IP > IP > Protocol Type	89	Action > IP > Add > High Queue	See Table 5-9 in Chapter 5 for a list of common IP Protocol and Type codes.
Place OSPF/ BGP traffic in the High queue	Criteria > Add > IP > IP > Type of Service	0xE0	Action > IP > Add > High Queue	
Place Spanning Tree Protocol (STP) traffic in the High queue	Criteria > Add > Datalink > Source Routing > DSAP | SSAP | Control	0x42 (DSAP or SSAP) 0x03 (Control code)	Action > Datalink > Add > High Queue	See Table 5-3 in Chapter 5 for a list of SAP codes.
Place synchronous pass-through traffic in the High queue	Criteria > Add > Datalink > 802.2 SNAP Ethernet	0x80FF	Action > Datalink > Add > High Queue	
Prioritize FTP, Telnet, and other large-packet data traffic by placing smaller packets in the Low queue	Criteria > Add > IP > Source Address	Client IP addresses	Action > IP > Add > Length	In the Prioritization Length window, specify: Packet Length = 500 bytes Less Than or Equal Queue = Low Greater Than Queue = High

Implementation Notes

This section contains notes about the following:

- Filtering Outbound Frame Relay Traffic
- Filtering over a Dial Backup Line
- Using a Drop-All Filter as a Firewall
- Using Outbound Traffic Filters for LAN Protocols

Filtering Outbound Frame Relay Traffic

When creating outbound filters for Frame Relay traffic, keep in mind that Frame Relay packets in the Low queue have the discard eligible (DE) bit set by default. The DE bit is off by default in Frame Relay packets in the Normal and High queues.

You can change the default setting of the DE bit for packets in the Low and Normal queues using the Edit Protocol Priority Interface window. See "Enabling Protocol Prioritization" in Chapter 2 for instructions.

Filtering over a Dial Backup Line

When configuring protocol prioritization on a synchronous interface on which you have configured a dial backup line, consider the following:

- If the primary line is running PPP and the line fails, the router automatically transfers all of the priority queues and outbound traffic filters you have configured on the primary line to the backup line.
- If the primary line is running a WAN protocol other than PPP and fails:
  - -- The router transfers IP outbound traffic filters to the backup line, regardless of which protocol was running on the primary line.
  - -- The router does *not* transfer data link protocol prioritization or outbound traffic filters to the backup line. You must manually configure new data link outbound traffic filters on the backup line after that line is activated.
- Be careful when configuring outbound traffic filters on a backup line. As soon as the primary line is reactivated, it uses the priority queues and filters you configured for the backup line. These priority queues and filters may be completely inappropriate for the protocol running on the primary line.

Using a Drop-All Filter as a Firewall

If your filtering strategy involves forwarding most traffic and dropping only specified packets, you need only configure filters with a drop action (*Drop filters*) for the traffic you want the router to reject.

If your strategy involves blocking most traffic and accepting only specified packets, begin by defining filters to accept specified packets (*Accept filters*). Then, add a filter on the interface to drop all packets (a *Drop-all filter*).

A Drop-all filter describes the broadest range of packets you want to block from an interface. To ensure that all unwanted traffic is dropped, configure the Drop-all filter to contain:

- Criteria that appears in *every* packet of the protocol you want to filter
- The maximum value of the range
- The minimum value of the range

With a Drop-all filter, higher-precedence Accept filters create exceptions (or "holes") in the drop-all range. Since the highest-precedence filter in a given address range determines the result of combined filtering within that range, the router will process packets that match the Accept filters. However, the Drop-all filter ensures that the router rejects all other traffic.

For example, to configure a circuit that only accepts IP traffic addressed for destination address 192.32.28.55, apply a Drop-all filter and one Accept filter, as follows:

Filter Action	Rule Number	Start of Range	End of Range
Accept	1 (highest precedence)	192.32.28.55	192.32.28.55
Drop	2 (lower precedence)	0.0.0.0.0	255.255.255.255

See "Changing Filter Precedence" in Chapter 6 (inbound traffic filters) or Chapter 7 (outbound traffic filters) for information about using the Configuration Manager to change filter precedence after filters have been applied to an interface.

Using Outbound Traffic Filters for LAN Protocols

In certain configurations, implementing outbound traffic filters for LAN protocols may cause a decline in throughput performance. For LAN circuits where the forwarding rate of the router is critical, Bay Networks recommends that you monitor the throughput performance after configuring outbound LAN traffic filters.

If you notice an unacceptable decline in performance, use inbound traffic filters to accomplish the filtering goal.

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